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Teemu Santonen (ed.)

Living lab business models and services –
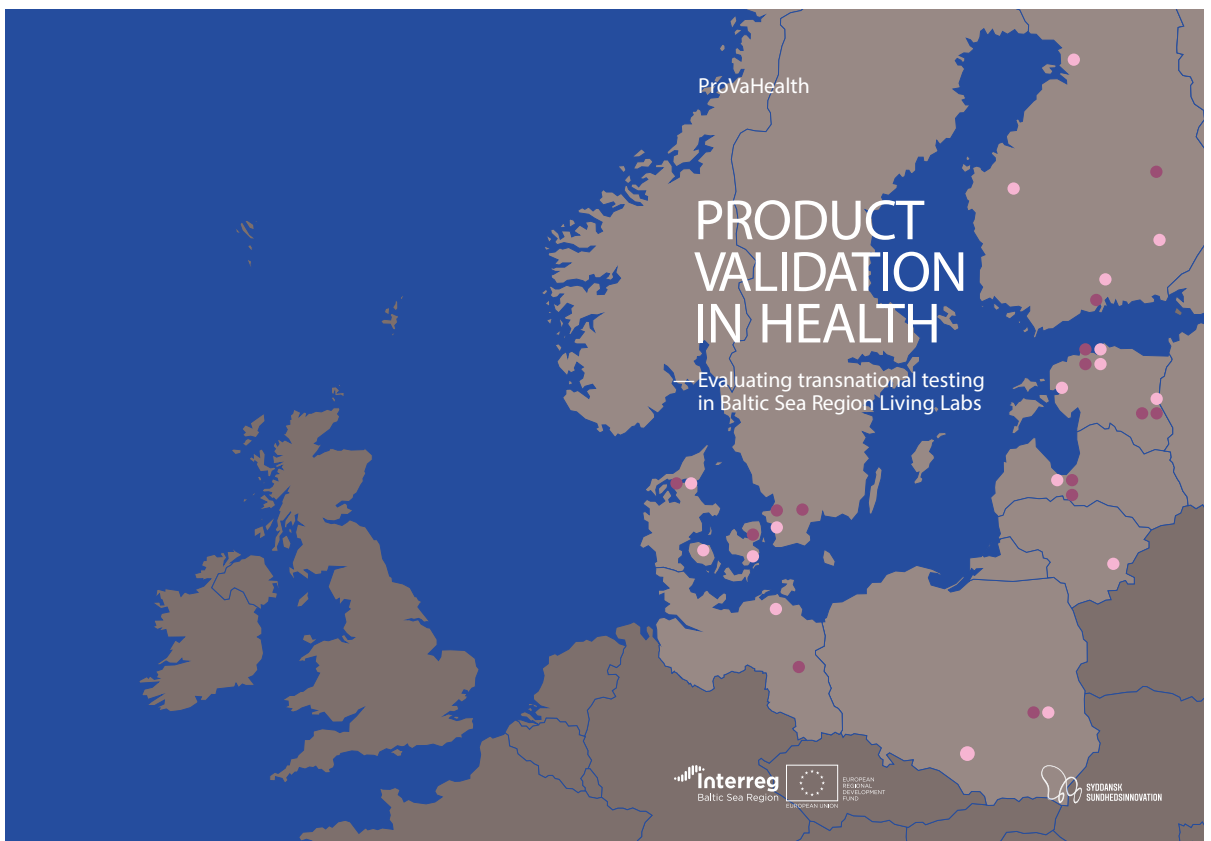## Key findings from Product Validation in Health (ProVaHealth) project

Living lab business models and services

Key findings from Product Validation in Health (ProVaHealth) project

EXECUTIVE SUMMARY

Product Validation in Health (ProVaHealth) was an Interreg Baltic Sea Region funded three years project (October 2017 to March 2020) to stimulate collaboration between fifteen health and wellbeing living labs across the Baltic Sea. Living lab by definition is a multi-stakeholder driven user-centered open innovation approach to co-create and test novel solutions in real-life environments. This report presents the key findings regarding the development efforts to co-create sustainable business models and services for living labs to support SMEs and start-ups internationalization efforts.

The analysis of 101 different business model attributes revealed that current and future business models among ProVaHealth consortium living labs were multifaceted, but also some common elements were found. Focused (N=5 out of 15), balanced (N=8) and maxed-out (N=2) business model strategies were identified, referring to how widespread the living lab strategy scope was. The current living lab business models are expected to evolve in the near future. Fine-tuning (N=2), minor adjusting (N=7), the re-scoping (N=5) or the frog leaping (N=1) change strategies were planned to apply, referring to the magnitude of the planned change. In all, the change strategies were grounded on an idea of "more is better", since the importance of the individual business model attributes are about to grow. Nevertheless, only two living labs were planning to change their strategy type from focused to balanced business model strategy.

Local and regional innovation network and ecosystem had a great impact on the possibilities to run a living lab. Citizen, local authority, industry, intermediary (or widespread) and state driven partnership models were detected among living labs. As a result, the living lab business model is, in fact bounded by the possibilities and restrictions derived from the surrounding partners and ecosystem. A partnership strategy grounded on widespread partnerships is suggested as the best choice for living labs when possible, since partnerships

ProVaHealth

PRODUCT VALIDATION IN HEALTH

— Evaluating transnational testing
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have a tendency to lead to customerships.

Personnel and infrastructure costs are the most important cost elements for living labs, thus making the living lab approach difficult to scale. Unique infrastructure had positive impact on getting projects, but caution should be exercised, as investments have not always paid out, even if they had an impact to gain more customers and projects. Public project grants and fixed funding are the dominating revenue sources now and in the future, making living labs greatly depend on the availability of the public funding programs.

The key living lab services includes (1) innovation network orchestration and funding support, (2) project planning and management, (3) market and competitor intelligence services, (4) co-creating products, services and processes, (5) testing and validation services, (6) business advisory and management consulting, and (7) marketing and sales support. The content and the terminology associated with the services, are greatly varying between the living labs.

To conclude, at the moment "one-size fit all" business model approach is not a suitable starting point to establish transnational living lab network. Therefore, opportunities for transnational cooperation should be sought from smart specialization strategy, in which living labs have their own special approach, but as a whole, they could offer comprehensive services. Nevertheless, it is highly recommended that also a common set of

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1   INTRODUCTION

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1.1   PROVAHEALTH PROJECT IN BRIEF

ProVaHealth was an Interreg Baltic Sea Region funded three years project with a €2,7 million budget. ProVaHealth facilitated access to health infrastructures for startups and SMEs (small and medium sized enterprises). It promoted commercialization based on excellent client validation opportunities, hands-on feedback and input for product development. The project was coordinated by Tallinn Tehnopol, Estonia.

ProVaHealth involved 15 health Living Labs from the Baltic Sea Region and it worked together with Scan-Balt and the European Network of Living Labs. Living labs were defined as user-centered, open innovation ecosystems based on a systematic user co-creation approach integrating research and innovation processes in real life communities and settings (http://www.openlivinglabs.eu/).

ProVaHealth stimulated cooperation among health Living Labs in the Baltic Sea Region. ProVaHealth tackled the challenge of a slow market uptake of innovations as well as Living Lab infrastructures serving only locally or regionally. The project shared partner´s best practices to improve their business models. Also, based on best practices, the project improved the partner labs and their open access services bringing product development services to many SMEs.

ProVaHealth has produced a Self-Evaluation Toolbox for Living Labs, tested within 14 ProVaHealth Living Labs. Also, a Transnational Living Lab Concept, including a service model, based on the needs of health SMEs from all BSR countries was created. At the end of the project 14 partner Living Labs have had their long-term business plans constructed. 14 SMEs had their service and/or product validated through ProVaHealth project procedures.

For more information:

http://projects.interreg-baltic.eu/projects/provahealth-105.html

http://scanbalt.org/product-validation-health-provahealth/

Living lab is a user-centered research and open innovation approach operating in a real-life or real-life kind of environments in which diverse groups actors are together developing and/or testing in a co-creative manner new solutions at different stages of innovation process while utilizing various research, development and testing methods via systematic methodology. This report presents the key findings of the Baltic Sea region health and wellbeing living labs development efforts to co-create sustainable business models and services to support SMEs and start-ups internationalization efforts.

The report starts by defining the key characteristic of living labs including (1) open innovation 2.0 eco-system, (2) multi-stakeholder participation, (3) user-centered innovation process, (4) real-life or simulated setting, (5) systematic multi-method approach and (6) iterative co-creation process. Secondly, living lab innovation process phases are clarified and aligned to the models described in (A) product/service development and (B) user-centered innovation and design research literature.

Third, commonly known and extensively utilized Business Model Canvas (BMC) approach to describe business model was adopted as theoretical framework to co-create business models for participating living labs. The report shortly summarizes the key elements of BMC and describe how Living Lab Business Model Canvas (LLBMC) survey tool was co-created to enable empirical evaluation of consortium members current and future (2021) business models. In addition, the prior research findings regarding living lab business model are shortly summarized.

The LLBMC tool consisting 101 different business model attributes were applied to ranking order the individual business model attribute relevance among ProVaHealth consortium members. A heat map summarizing the consolidated current and future (2021) business models is presented to show at one glance which attributes are the most important within ProVaHealth consortium. Report includes also an easy to understand result table which compares the mean values of current and future (2021) situation and indicates when the change is statistically significant.

The report continues by describing the research methodology for co-creating a common terminology for living lab services and align them to identified SMEs research, development and business needs. Like in the case of LLBMC tool, a similar heat map visualization is presented to highlight, which services are the most common among consortium members.

For each ProVaHealth consortium member (1) living lab hosting organization description and contact information, (2) core team members, (3) business model profile, (4) service portfolio and (5) a case example representing their project actives are presented.

Finally, conclusion based on in-depth interview among consortium members are presented regarding underlying factors of influencing living lab business models.

2 WHAT IS A LIVING LAB?

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As typically in scientific literature, there is no universally accepted definition for living lab (later also LL) term and plenty of other rivalling terms describing somewhat similar concept have emerged including such as testbed, citizen science and community-based participatory research (Santonen, 2018). According to the European Network of Living Labs (ENoLL) – the international federation of benchmarked Living Labs in Europe and worldwide, thus considered as an authority – defines LLs as:

"User-centred, open innovation ecosystems based on systematic user co-creation approach, integrating research and innovation processes in real life communities and settings. They operate as intermediaries among citizens, research organizations, companied, cities and regions for joint value co-creation, rapid prototyping or validation to scale up innovation and businesses. LLs have common elements but multiple different implementations."

In Figure 1 the key components of the living labs are illustrated and afterwards shortly described.

Open innovation 2.0 ecosystem: The original definition of open innovation referred to an approach in which a firm uses internal and external ideas as well as internal and external paths to develop their solutions (Chesbrough, 2003). To address the critiques and clarify the open innovation concept, Chesbrough and Bogers (2014) provided a refined definition for open innovation: "a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model". However, these definition are mainly focusing on firm-centric point of view and therefore are not fully fitting to Quadruple Helix driven innovation ecosystems
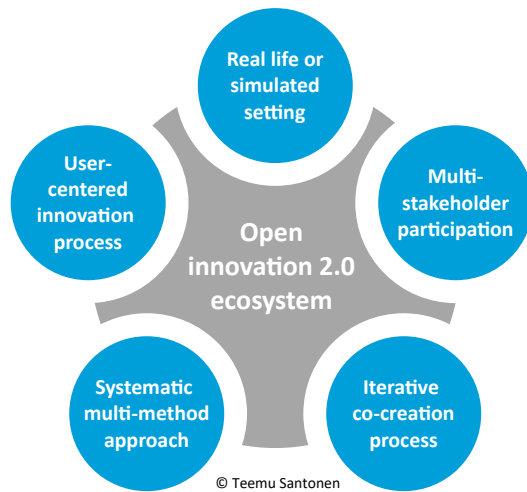
Figure 1: Key components of the living lab (own illustration based on Malmberg and Vaittinen, 2017)

(Arnkil et al. 2010), which are grounded on the collaboration between public authorities, private industry, academia and civil participants. Therefore, a novel open innovation 2.0 (OI2) paradigm has been proposed to describe ecosystem centric cross-organizational co-creation collaboration between all actors in society which drives changes far beyond the scope of what any one organization can do on their own (Curley and Salmelin, 2013).

Multi-stakeholder participation: Solving complex problems such as health and wellbeing in a society requires seamless collaboration among diverse set of actors, which have different, complementary, and often controversial knowledge and skills. Yet, collaboration is compulsory since without it, collective intelligence is not emerging to generate new knowledge that neither of the collaborators previously possessed. As a result, it is argued the ongoing innovation system paradigm change towards open innovation 2.0 regionally, nationally and transnationally calls out new tools and approaches such as Quadruple Helix driven living labs. Basically, Quadruple Helix is an extension to Triple Helix model, which was defined to describe university-industry-government interactions to foster innovation (Etzkowitz and Leydesdorff, 2000). Quadruple Helix as a concept is still infancy and various meanings for added 4th pilar has been suggested to extend the original three pilar based model beyond university-industry-government collaboration. Intermediate organizations, public and users have been suggested for 4th candidates (Liljemark 2004; Yawson, 2009; Carayannis & Campbell, 2009). Some authors have even taken a step further and extended Quadruple Helix model with an additional 5th dimension, which represent the nature and named the model as Quintuple Helix (Carayannis et al. 2012).

In context of living labs, the 4th dimension of Quadruple Helix is typically referring to end-users (i.e. a person who ultimately uses or is intend to use a product or service) or customer (i.e. the recipient of a service or product). However, when large group of people having such a diverse background and objectives collaborate, it can easily reduce innovation performance due perceived disagreements among group members relating their opinions, ideas and working methods. Therefore, Santonen (2016) has proposed a framework for mana-

ging diversity driven open innovation potential, which goes beyond quadruple helix. The framework argues that in participants for multi-stakeholder collaboration should include users having different demographic, cultural, organizational, cross-functional, industry and discipline backgrounds in order to redeem the assumed benefits of multi-stakeholder collaboration. In all living labs can be considered as an adaption of participatory design and participatory research approaches since they highlight the critical role of the people destined use the developed solutions (Schuler and Namioka, 1993) as well as researcher-designers must come to conclusions in conjunction with users (Spinuzzi, 2005).

User-centered innovation process (also user-centric synonym is used): Living lab approach is grounded on an idea of democratizing innovation in other words the users of products and services are able to innovate for themselves (von Hippel, 2005). User-centered design as a term is broadly speaking describing a process in which end-users can influence how a design (or innovation) takes shape (Norman and Draper, 1986). Arnkil et al. (2010) compared the differences between user-centric, user-oriented and user-driven concepts – all grounded on an idea of involving users as a part of innovation process, but varying the intensity of user involvement. Most typically living lab approach is considered as a user-centered innovation process — products or services are co-created with the users — indicating that user feedback and interaction had an influence on the developed solution but users were not controlling or financing the innovation activities. User-driven approach takes user involvement a step further and can be used to describe an approach when users are true initiators and leaders of an innovation process (Bergvall-Kåreborn et al. 2009a). Different types of user groups have been identified (Eason, 1987) including (1) primary users a.k.a. those who actually use the product or service, (2) secondary users who occasionally or through an intermediary uses the product or service and (3) tertiary users who are affected by the product or service or have an influence on making the purchase decision. Also Arnkil et al. (2010) listed different user groups including such as ordinary, amateur, consumer, citizen, employee, resident, hobbyist, civil society association, organization, firm, professional, lead and non-user. In all it is highlighted that living lab innovation process should engage all the relevant user and stakeholder groups in order to offer diverse viewpoints for development activities.

Real-life or simulated setting: Real-life setting is a peculiarity characteristic of a living lab approach (Dell'Era and Landoni 2014). Real-life requirement is associated on the environments where the development activities take place, as well as to users who are taking part of development activities (Bergvall-Kåreborn et al. 2009b). The main aim of the living lab approach is to create realistic usage situations in which real-users are interacting with real or real like solutions in real-life or simulated physical or digital environments. Importantly it has been highlighted that different users and stakeholders face different realities (Bergvall-Kåreborn et al. 2009b).

Systematic multi-method approach: When adapting dictionary definition, systematic in context of living lab denotes to an approach that follows an organized – often detailed – plan describing how to utilize different set of research and co-creation methods during the living lab innovation process. Thus, all living lab projects should follow a pre-defined research methodology, which describes a general research strategy how, and when to use different user engagement, data collection and analysis methods (Howell, 2012). Multi-method approach requirement refers to a need to apply combinations of methods that include in a substantive way more than one data collection procedure (Fetters and Molina-Azorin 2017). Depending on the research setting, this can be achieved by exclusively qualitative or quantitative approaches or combination of qualitative and quantitative approaches. Depending on the innovation process phase, living lab methodology can include various methods such as questionnaires, interviews, focus groups, human factors, ergonomics, usability testing, contextual inquiry, applied ethnography and lead user innovation (Dell'Era and Landoni 2014).

Iterative co-creation process: When developing novel solutions, it is difficult to get everything right at first time, especially when developing a solution to a complex problem. Thus, living lab process is grounded on an idea of iteratively elaborating and refining the solution throughout the innovation process in which each iteration or round is making use of the findings from the previous rounds. The similar approach is commonly applied in agile software development where it is known also as a spiral model or a winwin spiral model (Boehm and Hansen, 2000). All user-centered approaches highlight the need to gain as much information about the users as possible before starting the development activities (Chamberlain et al. 2006). Furthermore, after each iteration round, researcher-developers have more information available, which reduces the risk of failure and enables flexible response if there is a need to make changes. Thus, living lab process can be considered as an iterative learning process combing diverse scientific, technological, market and/or user knowledge throughout the various phases of innovation process (Spinuzzi, 2005; Pérez-Bustamante, 1999).

3. Theoretical foundations of Living lab innovation process

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3.1　INNOVATION PROCESS IN LIVING LAB LITERATURE

It has been argued that living lab approach is a multi-staged innovation process in which the focus and shape of the solution enrich and clarify the further the process proceed (Bergvall-Kåreborn, 2009a). However, among scholars and practitioners there is no clear consensus what are the stages, and how many stages there should be (Arnkil et al. 2010). For example Feurstein et al. (2008) proposed that living lab process consist four phases namely Product Idea, Product Concept, Product Development, and Market Launch. Rits et al. (2015) argued that living lab process starts with a kick-off meeting among designer-researchers and instigator who enter into living lab process as client. After the kick-off meeting, the process continues with state-of-the-art market scan and series of user or stakeholder research activities and ending to final presentation of the project results. Partially by the same authors (Georges et al. 2015), examples of different living lab field trial projects were given varying the sequence of field trials, various types of workshops and online surveys, thus listing methods instead of describing the fundamental differences between the process stages. Bergvall-Kåreborn (2009a) proposed three-phased process – Generate Needs, Design, and Evaluate – which are repeated in three iterative cycles namely Concept Design, Prototype Design, and Final System Design. Schuurman et al. (2016) and Coorevits et al. (2018) proposed a very similar model including exploration, experimentation and evaluation phases. Due this confusion among living lab scholars and practitioners, there was a need to clarify and to define the living lab process stages by using insights from other research domains. The combination of user-centered design and new product development processes were taken as a starting point. The both define a multi-staged innovation process having similar activities, but using different terminology yet having also some fundamental differences (Veryzer and Borja de, 2005).

INNOVATION PROCESS IN PRODUCT AND SERVICE DEVELOPMENT LITERATURE

In many cases, living lab process is utilized to support new product or service development where a stage-gate process is commonly applied (Cooper, 1990). Thus, it is natural to seek solutions from new product/service development research domain where many development processes varying number of stages from three to thirteen have been presented (Tidd and Bodley, 2002). However, similar elements between the various model can be found (Veryzer, 1998). A typical innovation process includes (1) Opportunity Identification and Selection, (2) Concept Generation, (3) Concept/Project Evaluation, (4) Development and (5) Launch (Crawford, 2008). In very similar way, Page (1993) divides innovation process into (1) Concept search, (2) Concept screening, (3) Concept testing, (4) Business analysis, (5) Product/service development, (6) Product/service use testing, field-testing and market testing and (7) Commercialisation. Some authors consider the early phases of innovation process as the (fuzzy) front end of innovation which (1) consists opportunity identification, (2) opportunity analysis, (3) idea genesis, (4) idea selection and (6) Concept Development before proceeding to new product/service development, and commercialization (Koen et al. 2001).

As a result, similarities between the stages can be identified, even if the names and number of stages are varying. The product/service development innovation processes are typically also following so-called innovation funnel approach. The basic idea of the innovation funnel is that the number of item within each stage reduces the closer one come on the end-of the funnel (i.e. the innovation process proceed step-by-step from the start to the product/service launch and commercialization).In practice this mean that a company has numerous opportunities to proceed. For different opportunities, a large group of high-level ideas are proposed and best ones are selected for further development. The follow-up phase focuses on developing a small group of concepts describing in more detail the idea. Next, the best concepts are evolving into few prototypes and the best one is finalized into finished solution, and commercialized.

INNOVATION PROCESS IN USER-CENTERED INNOVATION AND DESIGN LITERATURE

As defined previously, living lab approach belongs to the family of user-centered innovation approaches. Therefore, we should also seek the process models from design thinking, user-oriented design and service design literature, since have their own understanding and terminology regarding the innovation process. A quick look to this research domain reveals that the terminology differs significantly compared to product/service development related innovation literature. In design thinking, the innovation process is typically divide into (1) exploration of the problem space, (2) exploration to the solution space, and (3) the iterative alignment of these two phases (Lindberg et al. 2011). The double diamond model proposed by Design Council (Council, 2015) is among the most well-known adaption of this kind of process and it includes (A) discover, and (B) define phases in problem space, and (C) develop, and (D) delivery phases in solution space.

Discover phase focuses on understanding what the problem is by applying divergent thinking approach. The aims is to identify the different kinds of needs, opportunities and problems and use them as a starting point for further development. Define phase follows convergent thinking approach and attempts to consolidate the large set of insights from the discovery phase into limited amount of clearly defined problems or opportunities. From these the most promising are selected as challenges to be solved during the follow-up innovation process. Develop phase is grounded on divergent thinking approach and aims to co-create multiple potential solutions for the selected challenges while Delivery phase is grounded on convergent thinking approach and focuses on testing and selecting which of the suggested options is the best. Typically, the interaction between develop-delivery phases evolves thru multiple iterations and after each iteration the solution

evolves to more mature before reaching to final commercial solution.

Design thinking processes can take many different forms including both circular and linear process approaches while varying the number of phases (Efeoglu et al. 2013). The circular processes includes the "never ending" circles such as (1) three-step Design Thinking approach having inspiration-ideation-implementation phases (Brown, 2009), (2) four-step model by Dunne and Martin(2006) including generate ideas, predict consequences, test and generalize phases, and (3) ME 310—Stanford design cycle (Stanfod University, 2011) including (re)define the problem, need finding and benchmarking, brainstorming, prototyping and testing. The linear process consists e.g. a linear version of The Stanford's Design Thinking process, which have evolved over time and included different number and names for phases such as understand, observe, point of view, ideate, prototype and test phases (Plattner et al. 2009) while currently using empathize, define, ideate, prototype and test phases. IDEO (2020) has proposed their own model including frame a question, gather inspiration, generate ideas, make ideas tangible, test to learn and share the story phase. It does not matter if it is a circular or a liner process, design thinking emphasizes that process can start at any phase and can jump between phases when needed (Brown, 2009).

CONCLUSIONS

To sum up the findings from various living lab, innovation and design literature, the initial phase of living lab process should include gathering information and insights about the various challenges, needs and opportunities among the users and customers within a targeted market environment. The discoveries from initial process phase represent possible business opportunities, which have not yet been fulfilled. The follow-up process phases should iteratively co-create and test multiple alternatives for defined development challenges, starting from high-level ideas and evolving to concepts, prototypes and finally ending to fully functional final solution ready to be commercialized.

Living lab process should also be flexible and allow a possibility to start at any stage while having a possibility to choose any process phase after concluding the ongoing phase. Finally, the process phase terminology should address both product/service development and design literature, since it would help marking the living lab services to diverse customers groups having prior knowledge from engineering, management or design.

4. DEFINING THE HEALTH AND WELLBEING LIVING LAB INNOVATION PROCESS

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4.1   OVERVIEW OF LIVING LAB INNOVATION PROCESS

The innovation process phases for health and wellbeing living labs were co-created by the ProVaHealth consortium members alongside the business model and service development. The utilized co-creation methodology is discussed in more detail in the business model development section, thus omitted in this section. The resulting innovation process in context of health and wellbeing living labs, is presented in Figure 2.
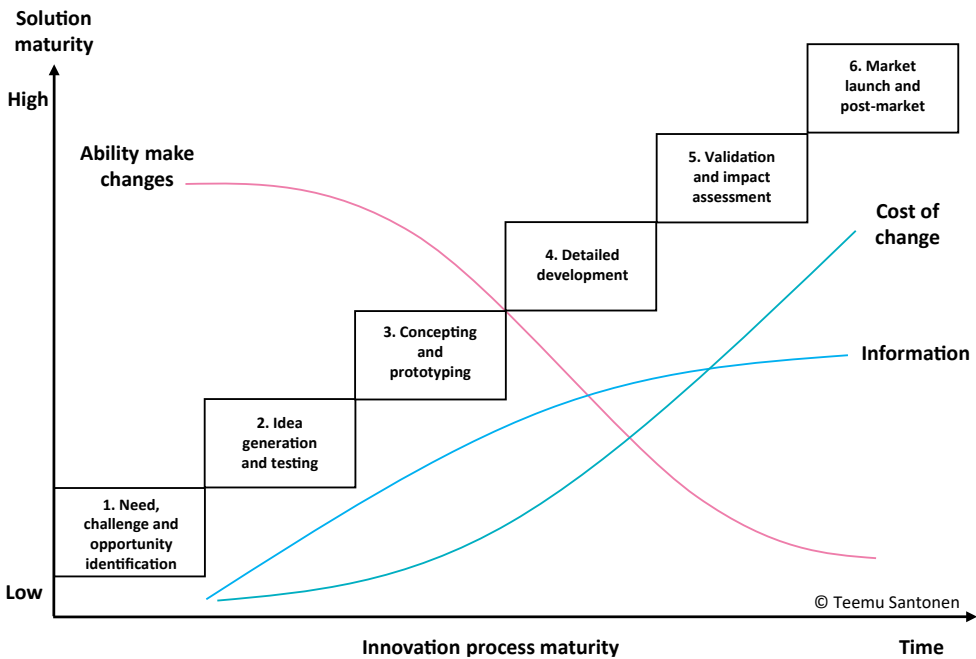

FIGURE 2. LIVING LAB INNOVATION PROCESS PHASES RELATIONSHIP TO AMOUNT OF INFORMATION, COST OF CHANGE AND ABILITY TO MAKE CHANGES (OWN ILLUSTRATION BASED ON ULLMAN, 1997 AND VON HIPPEL, 1993, HERSTATT & VERWORN, 2004)

The process includes following main phases and are described and defined in more detail in Table 1: (1) Need, challenge and opportunity identification, (2) Idea generation and testing, (3) Concepting and proto-typing, (4) Detailed product and service development (5) Validation and impact assessment and (6) Marker launch and post-market. Importantly, when proceeding from (1) Need, challenge and opportunity identification towards (6) Marker launch and post-market phase, the ability make changes is reducing dramatically especially when entering to (4) Detailed product and service development phase. The underlying reason for this weakness is related to the cost of making the changes. The further the innovation process proceeds, the more money has been invested in the process.

In the worst-case scenario, the ongoing process phase identifies a critical flaw in the solution, which ends up on terminating the whole innovation project. As a result, it is better to fail fast and early in the innovation process, when making changes is faster and cheaper. The amount of information about the targeted end-user and market needs are rapidly growing during the first phases. Thus, it is highlighted that a company should enter to living lab process as early as possible to reduce the risk of innovation failure. However, this is often not the case, since many customers approach living labs first time when they have advanced hi-fidelity prototype or nearly finished product or service, which performance and impact needs to be validated.

4.2   LIVING LAB INNOVATION PROCESS STEP-BY-STEP

First, before living lab project can start, a briefing session with customer is required (presented at bottom of the Figure 3). During the briefing the customer's (e.g. SME or a start-up) development and testing needs are clarified. In most cases, the briefing phase has value for the customer even if the proposal is not leading to a contract. Thus, it is suggested as a good opportunity to gain a better understanding of the many options that living labs has to offer for supporting the user-centered innovation process. When a living lab is preparing a project proposal e.g. in EU Research and Innovation programs such as H2020, Interreg Europe, European Social Fund or similar, the call text is acting as a briefing material.

Second, after the briefing a project plan, consisting the living lab project's research design, time frame and costs are made (the second lowest box in the Figure 3). Project planning is interlink with innovation network orchestration (presented at top of the Figure 3) activities to make sure that project is possible to implement according to the research design. Living lab as an approach is grounded on a Quadruple Helix colla-boration, systematic use of multiple methods and real-life or simulated environments. This kind of research setup requires motivating end-users and other key stakeholders to join the forthcoming project activities as well as ensuring that all the needed testing and development environments will be available during the proje-ct. Furthermore, doing research and development in healthcare environment in most cases is highly regulat-ed. Thus, a living lab project often needs to get an acceptance from an ethical committee or similar. Therefore, living lab actors are typically having in-depth partnership with various types of actors, which enables fast response to offer request or project calls. Finally, a project proposal is made to respond the client's research and development needs according living lab best knowledge.
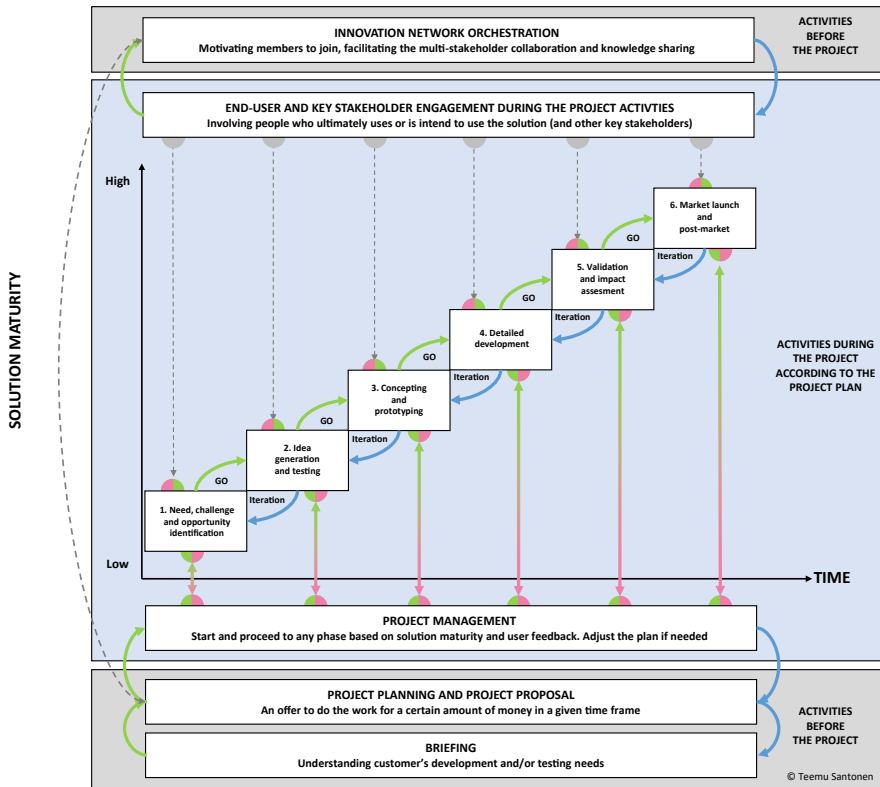
Figure 3. Living lab innovation process steps before starting the project (own illustration)

Third, various end-users and other key stakeholders are engaged to living lab project activities during the different process phases and the planned innovation process is implemented. Living lab process is based on iteratively elaborating and refining the solution based on received feedback from the end-users. Therefore, it is possible that the project plan sometimes needs to be adjusts. For example testing can reveal unexpected insights, which makes further development unnecessary. Therefore, project plan can and should be adjusted, if needed. Furthermore, living lab innovation process is flexible and can be started or continue to any process phases based on solution maturity and received end-user feedback.

Finally, Table 1 present in more detail the key activities, aim, typical methods and outcome of the different living lab process stages.

	PROCESS STAGE		KEY ACTIVITIES DURING THE PHASE	AIM OF THE PHASE	TYPICAL METHODS	OUTCOME OF THE PHASE
1	NEED, CHALLENGE AND OPPORTUNITY IDENTIFICATION	Discover	Identify various market demand, user needs, challenges, and competitive landscape including ecosystem conditions to get inspired and empathize with end-users.	Increase options by collecting market and user insights	Desk research, interviews, surveys and observations	Unstructured insights and market intelligence data
1		Define	Analyse prior discoveries to understand the users and market niche. Select the most potential opportunities and define clear challenge(s) to be solved or vision(s) to be achieved.	Decrease options by analysing prior insights	Content analysis and statistical methods	Shared understanding of the challenges, problems and needs (a.k.a. opportunities)
2	IDE GENERATION AND IDEA TESTING	Co-create	Co-create and generate as many high level ideas as possible with real end-users and other relevant stakeholders, which could solve the defined challenge or fulfil the vision. Use insights from prior stage as stimulants for ideation.	Increase options by ideating with end-user and other relevant stakeholders	Interactive workshops utilizing co-creation methods	Large quantity of high-level ideas, functionalities, features and hypothesis for value promise
2		Idea selection	Test your ideas with real end-users and other relevant stakeholders and select the best ones for further development. Keep your options open for different development paths.	Decrease options by selecting the best ideas based on collected feedback	Idea selection methods, interviews and surveys	Ranking of high-level ideas, functionalities, features and hypothesis for value promise
3	CONCEPTING AND PROTOTYPING	Co-create	Co-create with end-users and other stakeholders concept(s), which describe in written or visual format what user-needs are to be satisfied and how and prototypes enables a limited end-user interaction in real or simulated environment.	Clarify idea(s) by explaining the core features of the suggested solution(s)	Workshops, hackathons and design sprints	A set of concepts or concept alternatives grounded on verified ideas
3		Proof-of-concept test and prototyping	Test your low-fidelity/tech concepts and hi-fidelity interactive prototypes with real end-users and other relevant stakeholders. Select the best one for final co-creation phase.	Make a decision, which concept(s) is going to be fully developed	Concept and feasibility testing methods, interviews and surveys	Concept accepted by the end-users and other relevant stakeholders
4	DETAILED PRODUCT AND SERVICE DEVELOPMENT	Detailed development and design	Product and service development activities while collecting input from end-users and other relevant stakeholders when needed.	Develop fully functional solution	In house testing, unit testing, expert opinions	Fully (or almost fully) functional solution ready to be tested in real environment
4		Small-scale real life test and piloting	Conduct usability testing and small-scale validation tests in real life or simulated environments.	Verify that everything is working before heading to large scale or final impact assessment	Usability and integration testing	Small-scale exercise or pilot study to demonstrate and verify that a certain features or the general concept has practical value in real world
5	VALIDATION AND IMPACT ASSESMENT	Impact evaluation and large-scale piloting	Validate the full scale and fully functional product(s) or service(s) at system level in real environment with real end-users. Regulatory approvals and clinical test when needed.	Validate value promise, reliability and scalability	System level and large-scale piloting and impact assessment methods including clinical trials when needed	Fully working product or service intend benefits, value and compatibility with in the ecosystem is confirmed.
6	MARKET LAUNCH AND POST-MARKET	Market acceptance	Make product or service available for potential customers via trail production and market launch activities. Establish a post market surveillance system if needed and evaluate solution market performance.	Collect feedback for next version revision and tracking solution performance in the market	Interviews, surveys, observations	Providing input for product or service improvement

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TABLE 1: LIVING LAB INNOVATION PROCESS PHASES, AIMS, ACTIVITIES METHODS AND OUTCOMES

5. THEORETICAL FOUNDATIONS OF LIVING LAB BUSINESS MODELS

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5.1 WHAT IS A BUSINESS MODEL?

The scientific literature focusing on business models has been developed in silos and resulted numerous fragmented and inconsistent definitions (Osterwalder, 2004; George & Bock, 2011; Zott, et al. 2011). To simplify business model one should answer the following questions (Gassmann et al. 2014.):

- Who is the customer?
- What is offered to the target customer (i.e. the customer value proposition),
- How to build and to distribute the value proposition?
- Why the business model is financially viable (i.e. the revenue model)?

Even if there is not agreement among scholars about the definition, common business model elements can be found in the in the emerging literature (Nenonen and Storbacka, 2010). Especially the Business Model Canvas (BMC) consisting nine different elements has become popular approach to define, to describe and to analyze business models (Osterwalder and Pigneur, 2010). One might even argue that BMC is the most popular business model approach. Other business model canvases includes such as Lean canvas (Maurya, 2012), Service business model canvas (Zolnowski and Böhmann, 2014) and the Triple layered business model canvas (Joyce and Paquin, 2016) all following somewhat similar approach as BMC.

Due the popularity of BMC approach, it was also adopted to describe living lab business models among ProVaHealth consortium members. It is assumed that the familiar concept will help to disseminate the project results also for those who do not have prior experiences with living labs. Furthermore, there are many BMC case examples available from other industries, which also offers a possibility to compare ProVaHealth results with other industries. Therefore, the business model definition proposed by Osterwalder and Pigneur (2010) is adopted: "A business model describes the rationale of how an organization creates, delivers, and captures value"

5.2 BUSINESS MODEL CANVAS (BMC)

The BMC presented in Figure 4 includes the nine building blocks, which was also forming the basic theoretical framework for developing living lab business models during the ProVaHealth-project.

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS
The network of suppliers and partners that make the Business Model (BM) work	The most important things an organization must do to make its BM work	The bundle of products and services that create value for a specific *Customer segments*	Types of relationships an organization establishes with specific *Customer segments*	Different groups of people or organizations an organization aims to reach and serve
	KEY RESOURCES The most important assets required to make a BM work		**CHANNELS** How organization communicates and reaches its *Customer segments*	
COST STRUCTURE All costs incurred to operate a Business Model (BM)			**REVENUE STREAMS** Revenues an organization generates from each *Customer segment*	

FIGURE 4: BUSINESS MODEL CANVAS OSTERWALDER AND PIGNEUR (2010)

- **Key Activities** describe the most important things, which a company needs do, to make its business model work and deliver the value for its customers.
- **Key Resources** describe the most important physical, financial, intellectual, or human assets.
- **Partner Network** describe intelligently optimized partner and network selection which helps a company to have an access to the resources and capabilities, which they themselves are lacking in order to redeem the suggested positive effects of collaboration
- **Value proposition** describes the benefits what customers can expect from a bundle services and products which a company is offering.
- **Customer Segments** defines the various sets of people and/or organizations who share one or more attributes and to whom company aims to reach and provide a set of services and products.
- **Channels** defines different communication, distribution, and sales channels, which a company is using to reach and deliver it's products and services for the customers.
- **Customer Relationships** describes an ongoing connection and management process for facilitating relationships and interactions with company's current and potential customers.
- **Cost Structure** describes the most important financial consequences, which are incurred to execute the key activities and run the business model.
- **Revenue Streams** defines several ways how a company captures value and makes income from different customer segment by meeting their expectations.

5.3 PRIOR RESEARCH ON LIVING LAB BUSINESS MODELS

In all LLs have been struggling to find sustainable business models and most of them rely mainly on public grants (Santonen and Julin, 2019; Gualandi, and Romme, 2019). In all, the studies focusing on LL business models are rare, and in fact very little is known what kind of business models LLs are following. Rits et al. (2015) summarized the body of knowledge regarding LL business models and identified three main thematic areas within LL business model studies: First, there are studies evaluating multi-stakeholder driven collaboration. Second the studies that are discussing of how LLs could generate revenues by meeting the market needs. Third group of studies consider LL as a tool or a methodological approach to identify business model opportunities for organizations who are using LL services.

There has been few efforts to evaluate LL business models more structurally by utilizing Business Model Canvas (Osterwalder and Pigneur, 2010) or related Value Proposition Canvas (VPC) (Osterwalder, 2015; Coorevits and Schuurman, 2014). Mastelic et al. (2015) aligned European Network of Living Labs (ENoLL) member evaluation criteria into BMC approach and classified effective members into four innovation intermediary segment: innovation consultants - innovation traders - innovation incubators - innovation mediator.

Based on ProVaHealth results, Santonen and Julin (2018a, 2018b, 2019) developed and tested BMC survey instrument, which enables empirical comparison of the LL business models. D'Hauwers et al. (2015) proposed Assumption Board tool for LLs, which besides BMC and VPC integrated also Porter's five forces model (1985), business model matrix (Ballon, 2007) and Lean startup principles from Ries (2011) into one board. Katzy (2012) proposed living lab business excellence model, which inherits its idea from total quality management literature and give guidance to design and implement a LL. The model includes three stages named ideation, co-creation and venturing.

Also Schaffers et. al. (2007) adopted a stage model and highlighted that LL business model focus takes different forms depending on which of the following three evolution phases they are operating: (1) initialisation and preparation, (2) operation or (3) upscaling and commercialization. Authors also proposed preconditions and success factors such an importance of partnership design.

As a result, it is argued that the body of knowledge regarding LL business models is infancy and scattered. Therefore, the ProVaHealth-project could be considered as a pioneering project, since in our knowledge it is the first project to cover health and wellbeing living lab thematic area in transnational setting.

6. HEALTH AND WELLBEING LIVING LAB BUSINESS MODELS

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6.1 RESEARCH METHODOLOGY FOR EVALUATING THE BUSINESS MODELS

The living lab business descriptions presented in this report are based on co-creation efforts of the ProVa-Health-consortium members representing 15 different living labs from eight different countries. On the average, the participating living labs had been operated ca. 6 years (ranging from 1 to 13 years). The data collection activities for developing business models followed partially sequential mixed method approach (Leech and Onwuegbuzie, 2009). The research methodology is described by Santonen and Julin (2018a, 2018b, 2019) in more detail and therefore only the summary is presented here.

First, the participating LLs and their hosting organizations websites were analyzed to find basic information about their generic profile and activities. Second, the key informants of the LLs were contacted in face-to-face workshop during the project consortium meeting and the data collection process grounded on BMC (Osterwalder and Pigneur, 2010) was explained for them. After the consortium meeting the written guidelines and empty BMCs were emailed to all consortium members. Third, after receiving the BMC canvases the data analysis for open-ended responses was conducted as follows. The "master list" of the individual attributes including the different spelling variation and synonyms for each nine BMC elements was constructed. After several harmonization and coding iterations, the thematically similar attributes were combined into the single attribute and a simplified name with additional descriptions were given. As result a total of 101 different business model attributes divided between nine BMC elements were defined.

The empirical evaluation and comparison of the business models was conducted by developing Living Lab Business Model Canvas (LLBMC) survey tool. The tool was grounded on Quality Function Deployment (QFD)

0-1-3-9 scale (Franceschini and Rupil, 1999) in which (9) represented highly, (3) medium, (1) weakly relevant and (0) non-relevant attribute for respondents business model. LL's opinion regarding (1) the current state of the affairs and (2) the expected state by the end of the year 2021 were collected.

After about a year of filling the LLBMC-survey tool, living lab representatives were interviewed to find out the underlying factors and drivers behind their current and future business model selections. During the interviews, living labs had also a possibility to change their current and future responses, if their situation had for some reason changed. Therefore, the empirical LLBMC results presented in this report are slightly different from the results previously published by Santonen and Julin (2019). The interview results were transcribed and a conventional content analysis approach (Hsieh and Shannon, 2005) was applied.

6.2 OVERVIEW OF PROVAHEALTH CONSORTIUM BUSINESS MODELS

The Figure 5 and 6 consolidates the fifteen ProVaHealth living labs business model selections by presenting the mean values of each BMC attribute in a heat map. The individual attributes are color coded where green color indicates a high relevance and red color a low relevance. The BMC variables in both heat maps are ranked from left (highest mean value) to right (lowest mean value) on the basis of current status responses.

The detailed results summarizing the empirical findings of the fifteen ProVaHealth living labs current and future (2021) business models is presented in Appendix 1. In the appendix, the attributes within each BMC element are ranking ordered by the current state. Additional column indicating ranking order in 2021 is also presented in which white color indicates high ranking and gray color low ranking. The change in relevance is compared between future (2021) and current state. Nonparametric statistics test such as Kruskal-Wallis H, Wilcox Signed Rank and Friedman tests were applied to reveal significant differences between the future and current state. Significant mean difference (i.e. there is a genuine difference between future and current state) is indicated with * when significance 2-tailed is at level 0.05 and with ** when significance is at level 0.01.

BM ELEMENTS	LIVING LAB BUSINESS MODEL ATTRIBUTES – RELATIVE IMPORTANCE NOW						
KEY PARTNERS	Research org. [5.53]	Regional public org. [5.20]	Municipals and cities [4.80]	Networks and Clusters [4.67]	State level org. [4.13]	Digital service providers [4.00]	NGOs, and third sector org. [2.20]
	Education org. [5.47]	Secondary care org. [4.93]	Device manufacturers [4.73]	Tertiary care org. [4.13]	Primary care org. [4.00]	Preventive health / wellbeing service providers [3.07]	
KEY ACTIVITIES	Project mgmt. [5.13]	Testing and co-creation [4.73]	Funding support services [3.80]	Marketing and sales [2.80]	End-user services [1.80]	Support services to state authorities [1.27]	
	Education and training [4.87]	Ecosystem orchestration [4.27]	Support services to regional authorities [3.13]	Support services to local authorities [2.53]	Funding [1.47]		
KEY RESOURCES	Personnel [5.73]	Infra and technologies [4.40]	Partner(s) [3.80]	External networks [3.60]	User and patients panel [3.33]	Students [3.20]	Data and publication databases [3.13]	External experts [3.00]	IPR-portfolio [1.93]
VALUE PROPOSITIONS	R&D Services [5.80]	With real end-user [4.87]	Customized services [4.07]	Ecosystem and project mgmt. [3.87]	Funding support [3.60]	Method development [3.07]	Funding [2.33]
	Unique infrastructure [5.53]	Various positive arguments [4.33]	Multi-disciplinary [4.07]	Value and impact evaluation [3.73]	Education and training [3.20]	Marketing Support [2.40]	
CUSTOMER RELATIONSHIPS	Long-term relations [6.20]	Project based [5.93]	Direct personal contacts [5.53]	Networking [4.87]	Events [3.80]	Internal [3.80]	Co-creation with various stakeholders [3.67]	Steering [2.87]	Advisory [2.73]
CHANNELS	Co-operation projects [5.47]	Regional channel [4.47]	Educational channels [3.80]	Events arranged by LL [3.40]	Professional publications [2.80]	Scientific publications [2.73]	Online, mobile and social media [2.40]	Paid media and marketing [1.20]
	Direct channels [4.87]	Event participation [3.93]	Networks and cluster [3.73]	Owners or key partners channels [3.27]	Municipal and city channels [2.80]	Lobbying and policy channels [2.73]	State level channel [1.93]	
CUSTOMER SEGMENTS	Education org. [4.40]	Device manufacturers [4.13]	Research org. [3.93]	Municipals and cities [3.80]	State level org. [3.07]	Tertiary care org. [2.33]	NGOs, and third sector org. [1.47]
	Regional public Org.[4.40]	Digital service providers [4.00]	Secondary care org. [3.80]	Primary care org. [3.27]	Networks and clusters [3.00]	Preventive health/wellbeing service providers [2.07]	
COST STRUCTURE	Personnel [7.53]	Infrastructure and facilities cost [4.13]	Internal R&D development [3.13]	Travelling costs [2.67]	Consulting fees for external experts [2.27]	IPR-protection [2.20]	End-User fees and other variable costs [1.93]	Outsourced services [1.87]	Marketing and sales [1.73]
REVENUE STREAMS	Project grants [6.67]	Fixed or permanent funding [5.07]	R&D project and consulting service sales [2.00]	Education and training services [1.67]	Device and infrastructure rental [1.33]	Donations [1.13]	Royalties [0.80]	Event and site visit fees [0.73]	Equipment and device retail [0.40]

FIGURE 5: CURRENT BUSINESS MODEL BASED ON THE AVERAGE VALUE OF THE 15 PROVAHEALTH LIVING LABS

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BM ELEMENTS	LIVING LAB BUSINESS MODEL ATTRIBUTES – RELATIVE IMPORTANCE 2021						
KEY PARTNERS	Research org. [6.87]	Regional public org. [6.13]	Municipals and cities [6.00]	Networks and Clusters [6.67]	State level org. [4.33]	Digital service providers [5.60]	NGOs, and third sector org. [4.27]
	Education org. [6.73]	Secondary care org. [5.73]	Device manufacturers [7.00]	Tertiary care org. [4.80]	Primary care org. [5.07]	Preventive health / wellbeing service providers [4.40]	
KEY ACTIVITIES	Project mgmt. [6.20]	Testing and co-creation [7.80]	Funding support services [5.73]	Marketing and sales [4.87]	End-user services [2.13]		Support services to state authorities [3.00]
	Education and training [6.60]	Ecosystem orchestration [6.33]	Support services to regional authorities [3.93]	Support services to local authorities [3.73]	Funding [2.27]		
KEY RESOURCES	Personnel [6.87]	Infra and technologies [6.47]	Partner(s) [5.40]	External networks [5.40]	User and patients panel [5.47]	Students [4.93]	Data and publication databases [5.67]	External experts [4.40]	IPR-portfolio [3.00]
VALUE PROPOSITIONS	R&D Services [6.60]	With real end-user [6.40]	Customized services [4.87]	Ecosystem and project mgmt. [5.07]	Funding support [4.60]	Method development [4.00]	Funding [3.13]
	Unique infrastructure [6.60]	Various positive arguments [6.47]	Multi-disciplinary [5.80]	Value and impact evaluation [5.07]	Education and training [4.73]	Marketing Support [3.33]	
CUSTOMER RELATIONSHIPS	Long-term relations [7.53]	Project based [6.73]	Direct personal contacts [6.47]	Networking [6.33]	Events [4.93]	Internal [4.47]	Co-Creation with various stakeholders [6.07]	Steering [3.67]	Advisory [3.47]
CHANNELS	Co-operation projects [7.07]	Regional channel [4.93]	Educational channels [4.47]	Events arranged by LL [5.40]	Professional publications [5.20]	Scientific publications [3.47]	Online, mobile and social media [4.73]	Paid media and marketing [2.40]
	Direct channels [6.33]	Event participation [5.27]	Networks and cluster [5.93]	Owners or key partners channels [4.13]	Municipal and city channels [4.40]	Lobbying and policy channels [4.80]	State level channel [3.13]	
CUSTOMER SEGMENTS	Education org. [5.20]	Device manufacturers [5.27]	Research org. [4.53]	Municipals and cities [4.67]	State level org. [3.33]	Tertiary care org. [3.80]	NGOs, and third sector org. [2.80]
	Regional public Org.[4.93]	Digital service providers [6.27]	Secondary care org. [4.53]	Primary care org. [4.08]	Networks and clusters [5.00]	Preventive health/wellbeing service providers [4.47]	
COST STRUCTURE	Personnel [8.07]	Infrastructure and facilities cost [5.53]	Internal R&D development [4.80]	Travelling costs [3.20]	Consulting fees for external experts [3.07]	IPR-protection [2.60]	End-User fees and other variable costs [3.40]	Outsourced services [2.60]	Marketing and sales [3.47]
REVENUE STREAMS	Project grants [6.33]	Fixed or permanent funding [6.40]	R&D project and consulting service sales [3.33]	Education and training services [2.40]	Device and infrastructure rental [2.27]	Donations [2.27]	Royalties [1.73]	Event and site visit fees [1.60]	Equipment and device retail [0.53]

Figure 6: Future (2021) business model based on the average value of the 15 ProVaHealth living labs labs

6.3 PROVAHEALTH LIVING LABS BUSINESS MODEL STRATEGY CHANGES

The Figure 7 presents how the ProVaHealth living labs business model intensity is going to evolve in the future. The current horizontal axis and future vertical axis are comparing each living lab's relative position as to a situation if they had selected all the 101 business model attributes as non-relevant (i.e. selected value zero) or highly important (i.e. selected value nine). The size of the blue bubble in the Figure 7 represents the amount of relative change from current situation to future situation. We identified the following three business model strategies:

(1) Focused business model represent a strategy when a living lab has selected only few business model attributes highly important (i.e. attributes relative share from total score is less than 30 percent),

(2) Maxed-out business model represent an opposite strategy since all most all attributes are considered highly important (i.e. relative share from total score is more than 70 percent) and

(3) Balanced business model aims to avoid the extreme selections (i.e. relative share from total score ranges between 30 to 70 percent).
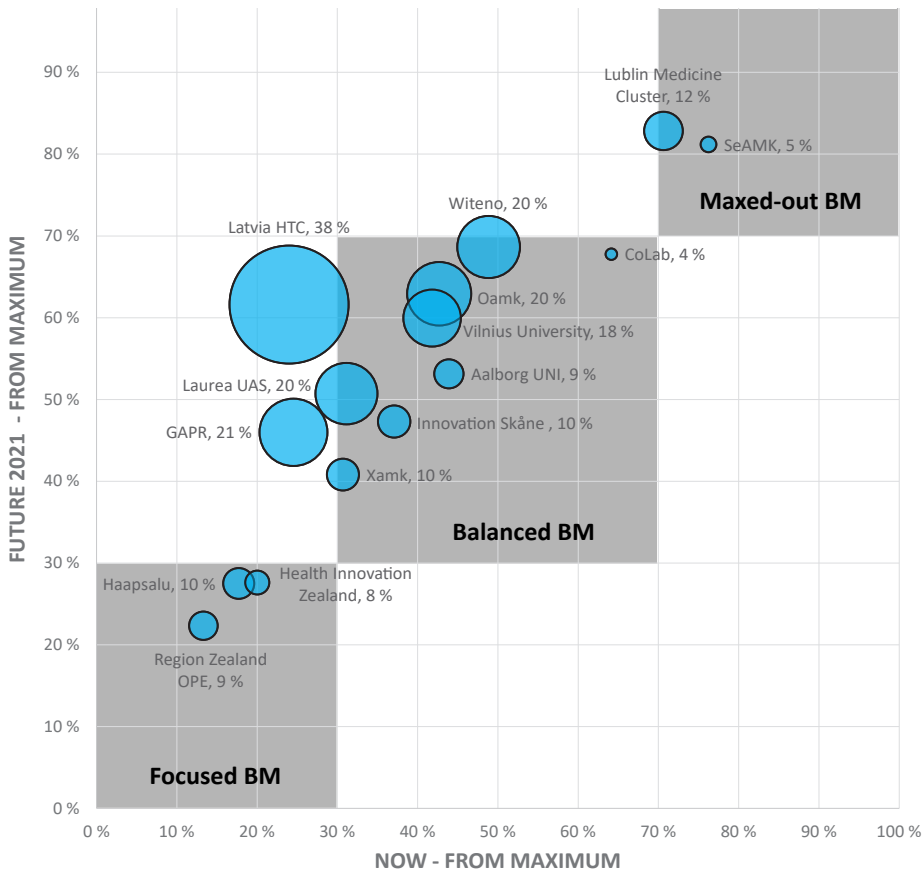
FIGURE 7. PROVAHEALTH LIVING LABS BUSINESS MODEL CHANGE INTENSITY

The following four change strategies for transforming current business models to future business models were identified.

(1) Fine tuning, where the relative change between current and future model is less than 5 percent,

(2) Minor adjustments, where relative change is ranging between 5 to 12 percent,

(3) Rescoping where relative change is varying between 18 to 22 percent and

(4) Frog leaping when relative change is more than 38 percent.

The Figure 8 classifies ProVaHealth living labs according change strategies and Figure 9 illustrate of how the three business model strategies – focused, balanced and maxed-out – are related to these change strategies.
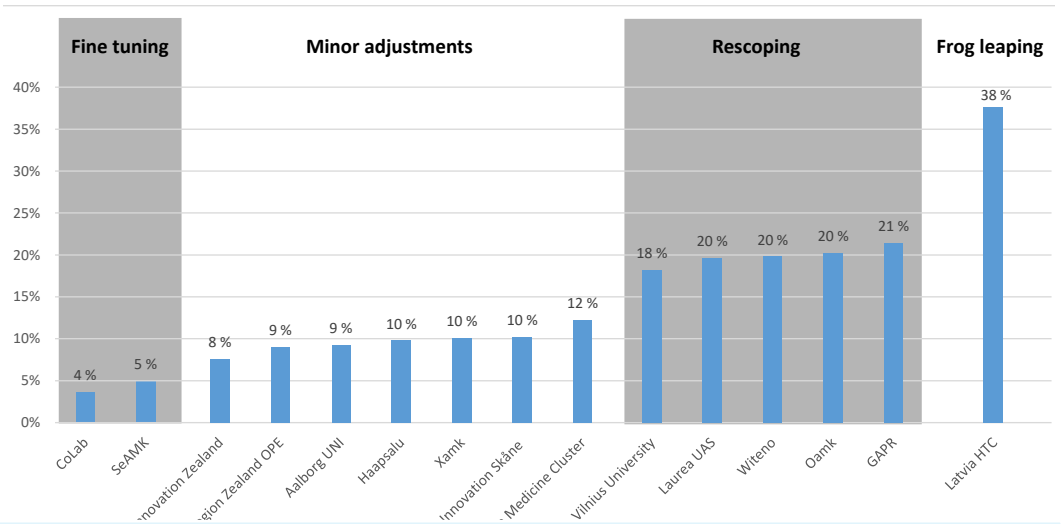
FIGURE 8. PROVAHEALTH LIVING LABS CHANGE STRATEGIES

FIGURE 9. BUSINESS MODEL TRANSFORMATIONS AMONG PROVAHEALTH LIVING LABS

Three living labs (Haapsalu, Region Zealand OPE and Health Innovation Zealand) have selected focused strategy and are intended to stick to it, even if they are planning to make some minor adjustments. GAPR and Latvia HTC living labs are planning to make a transformation from focused to balanced strategy, but their change strategy is different. Latvia HTC is the only living lab who is aiming to do a frog leap, since their business model plan is so significantly different than their current model. GAPR's current model is already at the edge of the balanced business model strategy and rescoping will lead them to follow the most popular strategy, balanced business model strategy.

Eight living labs are, now and in the future, following the balanced business model strategy. However, four of them – OAMK, Witeno, Laurea UAS and Vilnus University are planning to do rescoping, while three living labs – Xamk, Aalborg University and Innovation Skåne – will settle for minor adjustments. CoLab, whose current situation was closing to maxed-out strategy, is doing only fine-tuning their business model.

Lublin Medicine Cluster and SeAMK who are only one following maxed-out strategy are planning to keep it. SeAMK which starting position was higher than Lublin Medicine Cluster situation is only fine tuning their business model approach while Lublin Medicine Cluster will do minor adjustments.

7 DISCUSSING THE LIVING LAB BUSINESS MODELS

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The follow-up discussion is grounded on statistical analysis of Living Lab Business Model Canvas survey results and content analysis of living lab interview results.

7.1 LIVING LABS SHOULD ESTABLISH AS MANY PARTNERSHIPS AS POSSIBLE

Even if the mean values in the heat map indicated some importance differences between the different types of partners and customer segments, currently only NGOs, NPOs and third sector organizations (later NGOs) were statistically regarded least important partner or customer segment types. The key finding is that partnership has a tendency to lead to customer relationship with the same customer segment type (e.g. partnership with primary care organization will lead to customer relationship with primary care customer segment). Importantly, some partnerships appears to be more valuable, since their impact for stimulating customer relationships with certain customer segments are more widespread. Furthermore, by definition living lab as an approach is grounded on multi-stakeholder collaboration, thus this requirement needs to be fulfilled anyhow. As a result, it seems utmost important for living labs try to establish as many partnerships as possible. Having said that it is good to acknowledge that living lab partner and customer relationships are typically grounded on long-term relationships, which takes time to evolve. In the following typical partnership approaches are described.

Citizen driven partnership model: Currently only two living labs considered NGOs as highly relevant partners, while six living labs considered them as non-relevant. However, there is clear positive trend for making partnerships with NGOs by year 2021 and six living labs aims to gain highly relevant partnership with NGOs.

Identification of this trend is favorable, since NGOs as a partner has a positive impact on many customer relationships. Collaboration with NGOs leans more towards preventive care customer relationships, but has a connection also to primary care and tertiary care customer segments.

As a result, patient associations established to advocate certain patient group's interest are suggested as good counterparts when aiming to gain customer relationship with tertiary care organization. It is highlighted that NGOs provide a direct access point to enthusiastic end-users, having a special interests and therefore should be regarded as a driving force of all living lab activities. During the interviews, one living lab revealed that they have made partnership with another living lab outside of ProVaHealth consortium, who is maintaining a permanent user panel. Permanent user panel – own or provided by partners – is suggested as a potential approach for living labs to gain access to the end-users. However, interviews revealed also that in certain countries, regulation prevents living labs to maintain patient user panels.

Local authority driven partnership model: Many living labs have formed a deep partnership with local municipal and/or city authorities. Collaboration with local authorities also appears to amplify the partnership with educational organizations, NGOs and preventive care service providers. Thus, the model is somewhat related with citizen driven partnership model, but having more widespread impact on attracting various customer segments. In this model, living lab key activities include support services for local authorities as well as network management and orchestration of innovation ecosystem. Thus, in this model living lab is considered as a proactive player, whose responsibility is to create and foster collaboration, increase knowledge about living lab approach possibilities and make sure that all the relevant stakeholders are included into development and testing activities.

Local authorities are the only partner type who are in direct relationship within all health care provider customer segments (i.e. preventive, primary, secondary and tertiary care). Therefore, local authorities are suggested as a key component in any living lab partnership strategy. The tight collaboration with local authorities can partially be explain by the Finnish University of Applied Sciences (UAS) consortium members, who are owned by municipals from the region where the particular UAS is operating. In addition, one ProVaHealth living lab, Lublin Medicine cluster, is jointly managed by a local authority and university.

Industry driven partnership model: Industry driven partnership model is founded on establishing customership with device manufacturers and/or digital service providers. Interviews revealed that in some cases industrial partners are also used as a leverage to increase living lab credibility. This partnership approach is more straightforward especially in the case of device manufacturers. The key focus with device manufacturers is on developing and testing their solutions with real end-users via tailor-made living lab approach to please industry customer needs as good as possible.

The collaboration model with digital service providers appears to be more complex since it is intertwined with regional authority partnership. This model highlights also the network management and innovation ecosystem orchestration activities and refers to partnership with secondary care organizations. The suggested model is favored among those who are having fixed funding as revenue source. However, applying this collaboration approach is in conjunction with investment on unique infrastructure, which is also a part of living lab value promise alongside with impact evaluation.

The unique infrastructure strategy is not a risk free, since it requires investments and increases the operational costs. The identified positive correlation with unique infrastructure and invoicing based revenues indicates that the approach can support the transformation away from public project grant based revenue models. However, caution should be exercised before making the investments on expensive infrastructure and facilities. Interviews revealed that for some living labs, the investments has not paid out in the long-term,

and the infrastructure was dismantled.

Device manufactures and digital services providers were the key target groups for ProVaHealth-project. In the future, digital service providers are the most appealing customer segments for living labs, while device manufacturers are the runner-up selection. This finding is promising, when considering the ProVaHealth-project aim to establish a network of transnational living labs to support startups and SMEs to access to the health infrastructures. There is also a strong interest to start targeting more actively preventive care services providers. This indicates living labs interest slowly to shift towards private sector driven customer base to diversify their revenue sources.

Intermediary (or widespread) partnership model: The most advanced partnership model is combing multiple partnership models or seeking seek partnerships with as many partner types as possible. The justification for these models is two-folded. By definition living lab is grounded on multi-stakeholder collaboration, thus living labs are just trying to fulfil this requirement. On the other hand, intermediaries by definition fosters the collaboration between different types of partners and therefore it is logical to have a widespread collaboration network. However, the most important justification to select this partner strategy is the partnership's tendency to evolve to customerships.

State level cluster partnership model: Latvia as a country has selected a unique strategy to promote collaboration between industrial actors, public sector and research institutes. In Latvia, the partnership model is based on the nationwide health tourism industry cluster, which activities are directed by a specific long-term action plan. Besides supporting health tourism marketing activities and medical export services, the strategy consists also fostering research and development activities between the cluster members, scientific institutions and living labs. However, based on their living lab business model canvas responses, the current business model is focusing more on project management activities and running the cluster. Apparently, the cluster is still on working progress status since partnerships and many other business model canvas attributes are expected to evolve significantly by the end of 2021. Thus, the model will resemble the intermediary (or widespread) model, but it is grounded on a fee based cluster membership and state level support.

7.2 THE ECONOMICALLY SUSTAINABLE LIVING LAB BUSINESS MODEL REQUIRES SUPPORT FROM POLICY MAKERS

Currently and in the future, project grants and basic fixed funding are clearly the most dominating revenue sources for living labs. Project funding is gained by forming a project consortium and writing a winning project proposal to local, regional, national or EU level calls for projects. Thus, living lab revenues are mainly depending on their ability write winning funding proposals while providing grant writing support services other stakeholders can help to win the projects. Grant writing support se rvices are especially emphasized by those living labs, who highlight it in their value promise, and also provide education and training services. These activities are interlinked to local authority driven partnership model and are grounded on long-term direct relationships. The results indicate that especially the primary care organizations operated by local authorities do not always have their own dedicated resources or capability to manage the grant writing process. Thus, if a living lab desires to get public project funding, it must be proactive towards the local authority.

The fixed direct funding comes from the hosting organization owners or the regional or state authorities. The fixed funding can also be indirect from living lab activities point of view. Especially in the case of Finnish university of applied sciences, fixed funding is targeted for teaching activities, which then enables living lab activities in parallel with teaching. This kind of approach enables for example cost effective longitudinal data

collection when students are using novel devices and/or services as part of their studies.

However, **there is a tendency to diversify the revenue source portfolio in the future.** All other revenue source options, but project grants and equipment/device retail, are expected to increase their importance, but are not reaching to same level as the grants and fixed funding. Furthermore, out of 101 business model attributes, the project grant was the only attribute indicating importance reduction even if the mean difference between current and future state was not significant. High dependence on project grants make living labs vulnerable for policy maker's decisions to launch suitable project calls for living lab activities. Especially if living lab don't have any fixed funding from other sources or it is weak, the availability of public grants at local, regional, national and international levels are necessity. The changes in the political climate have already caused a domino effect on various business model factors among some ProVaHealth-living labs. Therefore, a long-term commitment from politician and policy makers is required to foster the spread of living lab movement.

At the moment, **the economically sustainable living lab business model requires support from policy makers** for example by providing funding instruments for SMEs and startups to test and co-create their solutions with living labs. This kind of indirect support would also foster the transformation towards fee based living lab projects, instead of relying on cumbersome call for project's funding approach. In addition, fixed funding targeted for multi-stakeholder driven living lab collaboration would offer better chances to establish long-term collaboration relationships between the different stakeholders. It is also important to understand that there are also varying legal restrictions influencing living labs possibilities to generate revenues e.g. from membership fees. These kind of restrictions influence also the possibilities to develop revenue models for transnational living lab network and should be considered when planning such activities.

The research driven living labs has also intentions to commercialize their IPR-portfolio by negotiating IPR-rights with the companies. For them IPR-royalties are expected to be important revenue source, but this is a rare strategy among the ProVaHealth consortium members.

Living lab activities as a user-centered approach are grounded on the interaction between various groups of people. Thus, it is not a surprise that **the personnel costs are the most important cost element now and in the future.** Living labs are also using part time employees and experts from own or external organization, who are recruited for a limited time and a specific task. This kind of dynamic resourcing model enables a better cost control and ability to use highly qualified experts when they are needed.

The second most important cost element **– the infrastructure and facility cost – are expected to increase.** This cost elements is somewhat more emphasized among those living labs, who ground their value proposition on unique infrastructure. Furthermore, having a research organization as customer, also increases the infrastructure and facility costs. This is relatively obvious, since development activities in such settings requires typically special equipment and/or environment. As mentioned before realistic calculations should be made, before making the investments on expensive infrastructure and facilities if infrastructure sole purpose is to support living lab activities.

In the future, there is also **a clear intention invest more on marketing and sales,** which so far have been modest. This should help living labs to raise awareness especially among SMEs and start-ups, who currently are not familiar with living lab services. Interestingly, a few ProVaHealth consortium member are also acting as a funding agency for those who are seeking funding for their development projects. Typically, direct funding support is targeted to relatively small projects. Anyhow, this kind of funding model could be more widely utilized to increase the awareness of living lab approach among the SMEs and start-ups. Obviously living labs are also expecting that their variable costs will increase in the future, due to the increased service sales.

8 HEALTH AND WELLBEING LIVING LAB SERVICES

AUTHOR: TEEMU SANTONEN

8.1 RESEARCH METHODOLOGY FOR CO-CREATING SERVICE OFFERING MODEL

The mixed methods research approach (Johnson et al. 2007) was applied to co-create living lab service offering model and services for SMEs and start-ups wanting to internationalize their solutions. Co-creation process included customer (i.e. companies) and service provider (i.e. living lab) viewpoints. These viewpoints formed the foundation for the service offering model and services presented in this report. The co-creation process was conducted as follows.

Living lab customer viewpoint: First, 82 semi-structured open-ended interviews were made in eight Baltic Sea Region countries by local living labs taking part to ProVaHealth-project. Interviewees consisted SMEs and start-ups who were developing products or services for health and wellbeing sector and were interested to internationalize. The prior experience on living lab projects varied from none to substantial among the interviewed companies to diversity the customer segments.

During the interviews respondents were asked to describe their 1) service/product solution offering including its current maturity level, 2) business model, 3) key customer groups, 4) target markets for internationalization, 5) prior experience and interest of using LL services, and 6) needs and expectations for using transnational LL services.

Interview summaries in English were written by using the common template and afterwards a conventional content analysis approach (Hsieh and Shannon, 2005) was applied by two experienced researchers in order create a typology for SME needs and expectations for transnational LL services. The detailed analysis and results of this process phase is available in "How transnational living labs can help SMEs to internationalize"

by Santonen and Julin (2019).

Living lab service provider viewpoint: During the ProVaHealth-project, inputs for the service offering model and living lab innovation process was collected from participating LLs via iterative process in six thematically distinct workshops during a 2-year period. The findings from workshops were analysed, summarized and iterated several times and used as input to all development activities during the project. At the end of the project, in January 2020, a dedicated workshop for ideating and conceptualizing the final living lab innovation process and service offering model in transnational context was carried out. During the workshop, the preliminary models were drafted and afterwards sent for commenting to the project consortium members. Besides commenting the model, living labs also indicated what kind of service portfolio they are offering and what kind of methods they are using when delivering their services. Based on the feedback and received service portfolios, the service offering model and high-level service descriptions were finalized.

8.2 LIVING LAB SERVICE OFFERING MODEL

Living lab service offering classification model presented in Table 2 consists following main services, which each can include one or more sub services. In the Table 2, main services are presented on the top of each column and example of typical services within each main service group are presented underneath of the headlines. For making the table more readable, every other column are colour-coded by blue or green colour. Services included into multiple main services are colour-coded by grey colour.

Innovation network orchestration and funding support includes facilitation of the process to establish productive working relationship between previously connected and unconnected parties, such as end-users, healthcare professionals, companies, public sector organizations, academia and NGOs. The core activities consists end-user and key stakeholder identification and motivating them to join and participate in the network and project activities on the ad hoc or permanent basis e.g. via permanent user panel. In order to operate successfully, innovation network need to form shared vision, which provides a path into the future. Thus, facilitating the shared vision building among the network members is included into key living lab activities. Increasing the awareness of collaboration possibilities is done by actively communicating and facilitating knowledge sharing among the network members e.g. by arranging events, training or site visits. Orchestration activities consists also establishing necessary structures and forums for collaboration as well as supporting the innovation network members' capacity building.

Currently, living lab projects are mainly funded by public grants. Therefore, grant writing a.k.a. funding application support service is extremely important activity for living labs. The funding support service typically means that a living lab actor is leading the grant writing process by identifying a suitable call for a project, forming a project consortium, and writing the majority of the project proposal on the behalf of the other project consortium members. Grant writing support is considered as a cross-cutting services, since it is also essential part of the project planning activity and therefore it is presented in grey color in Table 2. Finally, in some cases, living lab actor can provide funding for short-term small-scale experiment, if they have a role in managing public funding programs. In some cases, living lab can also rent facilities or equipment.

Project planning and management start with briefing session where a potential customer presents their research and development needs and describe the current status of their solution. Based on briefing, a project plan is made. The plan is defining the overall and process phase specific user-centric living lab innovation process. The plan describes the set of methods and approaches to be used for data collection during the planned project activities in set time frame. User engagement plan contains a description of targeted end-users

(and other relevant key stakeholders) as well as a description of the real-life or simulated environments where living lab process will take place. The possibilities of operating in real-life environments and engaging the targeted end-users and other relevant stakeholders in project planned activities, are closely intertwined with the opportunities offered by the local innovation network. Therefore, one should always critically evaluate in what kind of partner network (a.k.a. innovation network) a given living lab is operating.

Market and competitor intelligence services consist data and insight collection relating to future trends, competitors, similar products and services by using secondary research methods i.e. making synthesis on the basis of existing research, reports, documents, marketing materials etc. The aim is to identify a suitable target market give an estimation about the size of the demand in the market as well as understating the current and future restrictions.

Co-creating products, services and processes include various research and co-creation methods, and tools to facilitate the collaborative and iterative development efforts during the different innovation process phases. Among these are e.g. observations, shadowing, diary studies, ethnographic studies, interviews, surveys, user personas, customer journey, workshops, hackathons and design sprints. These services include collaboration and interaction with various end-users and other relevant stakeholder. Expert opinions, sparring and advisory services are also commonly used approaches.

Testing and validation services are using partially the same methods and approaches as the co-creation phases. However, the aim to test the developed solution attractiveness among the end-users and test can the solutions really be made. Testing methods includes test for (1) selecting and ranking ideas, (2) making feasibility and proof-of-concept tests, (3) doing simulations, testing usability and prototypes, (4) running small- and large-scale tests in real life environments to experiment and pilot test, (5) making impact assessments, validation test, clinical trials and regulatory approval tests and, finally (6) tracking the solution market performance and collecting for further development.

Business advisory and management consulting by giving expert opinions, sparring and advisory services on business modelling, risk and IPR-management.

Marketing and sales support activities include providing business contact and leads as well as giving visibility and credibility via (1) online presence in living lab websites and social media channels, (2) in showroom or during the events, and (3) issued "user approved" certificates.

LIVING LAB SERVICE CLASSIFICATION MODEL

INNOVATION NETWORK ORCHESTRATION AND FUNDING SUPPORT	PROJECT PLANNING AND MANAGEMENT	MARKET AND COMPETITOR INTELLIGENCE SERVICES	CO-CREATING PRODUCTS, SERVICES AND PROCESSES	TESTING AND VALIDATION SERVICES	BUSINESS ADVISORY, MANAGEMENT CONSULTING	MARKETING AND SALES SUPPORT
TYPICAL SERVICES						
Innovation network building and maintaining	Briefing	Expert opinions, sparring and advisory services				
Stakeholder identification, analysis and mapping	Key stakeholder engagement by using ad hoc or permanent innovation network members					Business contacts, sales and business leads
Grant writing and funding application support service		End-user engagement by using ad hoc or permanent user panel members			Risk analysis	Event arrangement
Building and maintaining shared vision for innovation network	Project planning	Interviews and focus groups			IPR-support	Online/on-site visibility presence
Capacity building: Training, knowledge sharing and awareness raising, site visits and event arrangement	Project management	Surveys				Public procurement support services
		User personas				"User approved" Certificate
User community building and user panels		Customer journey				Soft landing support
Funding		Observations, shadowing, diary studies and ethnography studies				Showroom
Equipment and facility rental service		Competitor and market analysis, benchmarking and other secondary research methods such as literature reviews	Ideation and other co-creation workshops (max 1 day)	Idea selection and testing		
				Concept, proof-concept and feasibility testing		
				Prototype testing		
		Foresighting including trends, weak signals and wild cards	Hackathons, jams and design sprints (2 to 5 days)	Simulation test		
				Usability testing		
				Integration testing		
		Technical requirements		Small scale real life testing, and experimentation		
		Legal, regulation and safety standard support		Large scale real life testing and piloting		
		Access to data		Impact assesment and validation testing		
				Clinical trials and regulatory approval tests		
				Post market (survailance) testing		

TABLE 2. LIVING LAB SERVICES OFFERING CLASSIFICATION

8.3   LIVING LAB KEY SERVICE DESCRIPTIONS IN BRIEF

The following short service descriptions are arranged in alphabetical order.

Access to data: Referring to service, which enables customers to access or retrieve data from one or more database consisting relevant data, which can be used for development or testing purposes.

Briefing: During the briefing, the customer's (e.g. SME or a start-up) development and testing needs are clarified for the project planning purposes.

Capacity building: training, knowledge sharing and awareness raising, site visits and event arrangement: Offering training for end-users and/or practitioners to improve their skills and knowledge about living lab approach, co-creation, iterative development and healthcare and wellbeing market. Stimulating knowledge sharing and awareness raising by publishing professional and scientific publications and arranging events, site visits and seminars.

Clinical trials and regulatory approval tests: Clinical trials are experiments or observations done to evaluate the effectiveness and safety of new solution by monitoring its effects on large groups of people. Subjects are typically divided into two or more groups, one having "real treatment" by using the developed solution and the other group(s) using tried-and-true solution or not using any solution. The results are compared between the groups to evaluate the impacts. Regulatory approval tests are testing the developed solution against the defined standards and regulatory process qualifications. Clinical trials and regulatory approval tests are similar to impact assessment and validation test activities, but follow more strict validation and approval process defined by regulation body.

Co-creation workshop: Workshop is a facilitated a group activity to find solutions for a specific problem by gathering ideas, solutions and insights from workshop participants while using variety of methods. Depending on the workshop focus, it may comprise ideation, concept development and testing. Typical duration for short workshop is from 45 minutes to 90 minutes, medium-length workshop from 90 minutes to 3 hours, and long-workshop from 3 hours to 1 day. The number of participants may vary depending on how many facilitators are available, and what kind of working methods are utilized. Typically, workshop facilitated by a single facilitator consist from six to eight persons. Number of participants are often even numbered to enable them to work in pairs.

Competitor and market analysis and benchmarking: Quantitative and qualitative methods are used to evaluate the size of the market both, in volume and in value. Customer segments, buying patterns, competition, and the economic environment are defined to identify the regulations and the barriers to entry. Defining the market by listing and describing current, future, direct and indirect competitors and analysing their competitive offering (e.g. SWOT) and user experience. Comparing offerings by measuring the performance of the developed products, services, or processes against those, which are considered to be the best in the industry. Can consist also literature reviews to a search and evaluate of the available scientific or professional body of knowledge for the given subject or chosen topic area.

Concept and proof-of-concept tests – feasibility study: Concept test is low cost and quick process in which high-level concept(s) is tested with real end-users via different methods such as interviews and surveys. In order to conduct concept test, preliminary concept description must exists in written or visual format, which is then communicated to the real end-users or experts. The main aim is to collect feedback for the initial concept proposal and its possible variations. Concept test can also include a feasibility study, which also covers technical, economic, legal, operational and scheduling issues relating the proposed concept. In all,

concept-testing phase verifies if a concept has market interest, while feasibility study shows if the product or service on the basis of concept can be developed. Collected feedback includes also improvement suggestions.

Customer journey: The customer journey map describes and visualizes the path of sequential steps and interactions that a customer goes through when interacting with a product and/or a service. Instead of viewing just a part of a transaction or an experience, the customer journey documents the full experience of being a customer.

Equipment and facility rental service: Offering equipment, labs and other facilities for rent.

Expert opinion, sparring and advisory services: Expert(s) who have long-standing practical and/or scientific experience in the field of enquiry provides a well-founded written or oral answers for your questions. Expert(s) are discussing your ideas and problems from a different angles to respectfully challenge, test and refine your ideas (e.g. as devil´s advocate looking for problems). Qualified and traceable arguments in favour of and against a specific position in an applied issue to support decision-making and development activities. Typically consists one-to-one relationship between the company and the expert, but may include opinions from multiple experts.

Foresighting (trends, weak signals and wild cards): Foresighting is a practice of exploring expected and alternative futures. Trend is a general tendency or direction evident from past events increasing or decreasing in strength of frequency of observation. A weak signal is an indicator of a potentially emerging issue that may become significant in the future. Wild card is high-impact event that seem too incredible, or is considered too unlikely to happen; yet many do happen.

Funding: Providing funding or investment for research, product and business development for small and medium-sized companies or start-ups. Typically funding is targeted for short-term small-scale experiments.

Grant writing and funding application support service: Offering tailored support by identifying the proper local, regional, national and international funding instruments, helping to write and manage a funding application process including finding the right partners for the project if needed.

Hackathon and design sprints: Typically 2-5 day event in which group of people will develop a solution to the predefined challenge by using a variety of co-creation methods. The outcome of the co-creation activity (i.e. the solution) can range from low-fidelity to hi-fidelity prototypes, mock-ups or written concept description for a product or service.

Idea selection and testing: Idea testing is low cost and quick process in which high-level ideas are selected (i.e. ranked) or tested with real end-users via different methods such as interviews, surveys or during the workshop. In order to conduct idea testing, different high-level ideas are pre-described in written or in visual format, and then communicated to the real end-users or experts. The main aim is to collect feedback to already existing idea proposal. Feedback can also include improvement suggestions.

Impact assessment and validation test: Impact assessment is a formal, evidence-based procedure that assess the total outcome that happened as a result of the tested activity, above and beyond what would have happened anyway. Depending on the duration and scope of the validation process impact can be evaluated on individuals, organization and society on short, medium and long term. Validation is the documented act of demonstration that a product or a service will consistently lead to the expected results. Validation test ensures that the product or the service actually meets the defined requirements and demonstrate that the solution fulfils its intended use when deployed on appropriate real environment.

Innovation network orchestration: Establishing productive working relationship between previously unconnected but complementary actor parties and helping them (companies, public sector, academia, and end-users) to work together properly and well. Deliverable(s): Connecting complementary actors, handling

conflicts and supporting interactions.

Interviews and focus groups: Interview is a qualitative research technique in which intensive face-to-face, phone or web-meeting interview is conducted with a small number of individual respondents to explore their perspectives on a particular topic. A focus group is a qualitative research method in which a trained moderator conducts a collective interview and make sure that the discussions focuses on the research questions. Typically focus group consist 6 to 8 participants who represent a sample of an end-user target group. The aim is to capture target group in-depth knowledge concerning experiences, attitudes, perceptions, beliefs and opinions regarding research question(s). Deliverable(s): Written report providing an overview and key insights.

Large-scale real-life testing and piloting: Similar to small-scale testing but longer duration or larger number of test participants who are representing the real end-users of the target group. During piloting, the aim is to evaluate the full scale and fully functional product(s) or service(s) at the system level in real environment with real end-users to make sure that the solution is scalable. Includes often impact assessment and validation testing.

Legal, regulation and safety standard support: Providing support to navigate in the legal, regulatory and safety standard requirements and help planning to meet the requirements.

Living lab project planning and management: Planning project goals, costs, schedule, list of deliverables, delivery dates and resources. Written project plan for one or multiple innovation stages is made. In the project management planned tasks are completed by executing, monitoring, controlling, and closing the work of a project team to achieve specific goals and to meet specific success criteria at the specified time.

Marketing and sales support: Providing marketing and sales support for 1) making right contacts by giving business contacts, sales and business leads, 2) setting up and arranging meetings and events, 3) showcasing products and services in a showroom or giving online/onsite visibility in living lab own communication channels, 4) providing "user approved" certification, and 5) offering soft landing support to help to setup business in given living lab country or region.

Observations, shadowing and ethnography studies: Observation (also shadowing) is a research technique that involves the direct observation of phenomena and people in their natural environment and describing what people actually do or what events take place during the activity. In the non-participant observation, researcher has no intervention, while in the participant observation researcher intervenes in the environment. Observation is a short-term activity. Ethnography is a qualitative research method in which a researcher—an ethnographer—studies a particular social/cultural group with the aim to better understand it. An ethnographer actively participates in the group activities in order to gain an insider's perspective of the group and to have experiences similar to the group members. Ethnography is a long-term activity. Deliverable(s): Written report providing an overview and key insights.

Panel research: Panel is pre-existing group of pre-screened people (e.g. patients, practitioners etc.) who have given their consent to take part in different research activities over an agreed period. Panel members have given their contact details and other profiling information, which enables fast recruitment for specific research activities as they come up.

Post-market surveillance and market acceptance testing: Post-market surveillance is a "real world" test of medical devices in patient subgroups. It is a practice of monitoring the safety of a medical device after it has been released on the market. Market acceptance testing focuses on collecting market feedback for the next revision development and tracking the solution performance in the real competitive market conditions.

Prototyping test: Prototyping test is a low cost and quick process in which product or service with limited functionality and interaction is tested with real end-users. Interactive prototype product or service must exists

so real end-users or experts can experience it. Prototype can be e.g. an interactive mock-up of a web service, which interface looks like a real thing. One can navigate thru different screens and see simulated content. Also the service prototype can consist role playing exercise to simulate service encounter. The main aim is to collect feedback on as real kind of user experience as possible, but with lower cost. Different methods such as interviews, surveys and observations can be used.

Public procurement support services: Public procurement is governed by EU and national rules. Support with public contract issues and public procurement process is given to help clients to meet the tendering criteria and/or join to the tendering process.

Simulation test: Simulation is a technique that creates a situation and environment, which allows end-users to experience a representation of a real event in a risk-free environment. Predefined simulation scenario defines a particular set of conditions to resemble authentic situations in a location where a simulation experience takes place to test and to gain understanding of tested solution and related human interactions. After simulation event, facilitators and end-users re-examine the simulation experience, and various aspects of the completed simulation are discussed.

Small-scale real life testing and experimentation: An experiment is a small scale and short-term preliminary study conducted to evaluate feasibility of the suggested product or service and to improve it based on the testing result. Testing includes a small number of test participants who are representing the real end-users of the target group.

Stakeholder (and partner) analysis and mapping: Identifying groups, organizations, and people who are relevant stakeholders. Prioritizing and ranking stakeholders based on their perspectives and interest. Mapping the relationship between different stakeholders and company objectives. Deliverable(s): Written report.

Surveys: The Survey method is the technique of gathering data by asking questions from a group of people who are thought to have desired information (i.e. representative sample group). A formal list of questions are prepared and statistical methodologies are used for analysing the results.

Usability testing: Usability testing is a technique used to evaluate a product by testing it in order to give direct input on how real users use or would use the product or service. Usability inspection is conducted when a professional evaluator inspects a user interface and gives an expert opinion regarding the usability. This approach does not involve real user. Usability testing with real users includes real users who have no prior exposure to the product or service.

User personas: A fictional characters created to represent different types of users, which might use the product or service while highlighting their needs, experiences, behaviours and goals.

9   CONCLUSIONS

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Living lab business models are multifaceted, but common elements can be found. To evaluate and to compare the ProVaHealth consortium members business models, the Living Lab Business Model Canvas (LLBMC) survey tool was co-created. The LLBMC-tool consisted from 101 different business model attributes divided between the nine business model canvas elements as defined by Osterwalder and Pigneur (2010). The comparison results revealed only weak to medium level correlations between the different living lab business models. However, when business models were compared by each nine main elements – partners, activities, resources, value proposition, customer relationships, channels, customer segments, cost structure and revenue streams, strong correlations between different living labs could be found. In all, individual business model attributes formed a complex relationships between each other. Interlinks between the attributes suggest, that certain types of actions and business model selection either open or close doors for living lab activities. Nevertheless, it is concluded that among the ProVaHealth consortium members a common business models cannot be detected to which everyone could be committed.

Since one-size fit all business model approach is not available, this will also have an impact on the plans to establish transnational living lab network. The impact is two-folded. On the other hand, it makes collaboration between different living labs more complex, since in some cases the common ground between the different actors is modest. In turn, it also open-ups possibilities for different living labs to found a specific profile based on their core competences. **When a group specialised living labs join their forces, as a network, only then they could offer all-inclusive services for SMEs and start-ups.** Nevertheless, it is also highly recommended

that a common set of shared services having identical content and terminology should be offered to make transnational living labs easier to approach.

It should be acknowledged, that living labs are often seen as one-dimensional testing support organizations. However, in reality, living lab role is much more complex. The recipe for sustainable business model is tightly intertwined to living lab ability to facilitate and to orchestrate local and regional innovation networks. From living lab, this will require devotion to various types of marketing, capacity building and support service efforts, for the other innovation network actors.

Focused, balanced and maxed-out business model strategies are applied. When comparing business model overall strategies, the following three approaches were identified: Focused strategy (N=5 out of 15), a living lab considers only few business model attributes highly important whereas maxed-out strategy (N=2) is opposite and considers most of the attributes important. Balanced strategy (N=8) avoid these extreme approaches. Focused and maxed-out strategies are less common than balanced strategy. Only two living labs were about to change their strategy type. The transformation is expected to take place from focused to balanced business model strategy.

Living lab business models are about to change in the near future. The following four approaches for making business model changes were identified: fine-tuning (N=2), minor adjusting (N=7), re-scoping (N=5) and frog leaping (N=1). In the case of fine-tuning only a few business model attributes are planned to changed. In minor adjusting change approach, about one third of the attributes will be altered while in scoping change consist about half of the attributes. In frog leaping three quarters of business model attributes are about to change. Even if almost all living labs were planning to stick in the same main business model strategy (i.e. focused, balanced or maxed-out), there was a clear tendency to widen the scope. In principle, more and more attributes will become important in the future, thus living labs are closing to maxed-out strategy. Importantly, only a few cases could be found where a living lab was planning to reduce the importance of an attribute. Thus, the future strategies are grounded on the idea of "more is better".

Citizen, local authority, industry, intermediary (or widespread) and state driven partnership models were detected each emphasizing different types of partnerships. It can be highlighted that the local and regional innovation network and ecosystem have a great impact on the possibilities to run a living lab. As a result, the living lab business model is in fact is bounded by the possibilities and restrictions derived from the surrounding partners. This is important, since it became evident that partnership with certain type of partner has a tendency to lead to customership with same type of customers. Therefore, a partnership strategy grounded on widespread partnerships seems logical choice for living labs.

Public project grants and fixed funding are the dominating revenue sources. Currently project grants are clearly the most dominating revenue sources for living labs. Fixed funding plays also a critical role and in the future it is expected to reach the same importance level as the grants. As a result, the existence of the living lab is greatly depending on the availability of the direct or indirect public funding programs having a short-term project focus (i.e. call for projects approach) or more longer-term focus, if having fixed funding for certain dedicated activities. Indirect support could include e.g. funding for SMEs and start-ups to co-create and test their solutions via living lab approach. To overcome the lack of funding, many living labs also provide grant writing support services especially for other public sector actors. The intention is to benefit from the funding also themselves. Alternative approach is to integrate living lab hosting organization other activities such as teaching as part of living lab operations. This will reduce the costs, but can also enable unique service possibilities which otherwise would not be possible.

Difficult to scale due high personnel costs. Personnel costs are the most important cost elements during

the living lab operations. Due to this reason, living labs are trying to control the personnel costs by dynamically resourcing the projects on the need basis. Dynamic resourcing is also interlink to capabilities and when special expertise is needed, external project personnel can be used.

Unique infrastructure value proposition involves a risk. Redemption of unique infrastructure value proposition involves a risk. The second most important cost element –infrastructure and facility cost –is expected to increase in the future. However, evidence has been found that investments are not always paying out even if they can have an impact to gain more customers and projects. Therefore, caution should be exercised and realistic breakeven calculations should be made, before making the investments. It is suggested that **transnational living lab collaboration could be grounded on smart specialization strategy,** in which each living labs have their own special approach, but as a whole, they could offer comprehensive services. The findings of not having a common business model among ProVaHealth consortium members is supporting this suggestion.

10 PROVAHEALTH LIVING LAB BUSINESS MODEL PROFILES IN BRIEF

SWEDEN

NORWAY

Ideklinikken
Aalborg University Hospital
The North Denmark Region

DENMARK

Innovation Skåne AB

The Health Innovation Centre
of Southern Denmark

Health Innovation
Zealand

WITENO

GERMANY

Oulu University
of Applied Sciences

FINLAND

South Ostrobothnia
Health Technology
Development Centre

RUSSIAN
FEDERATION

South-Eastern Finland University
of Applied Sciences

Laurea University
of Applied Sciences

Tallinn Science Park Tehnopol
Tallinn University

ESTONIA

Haapsalu Neurological
Rehabilitation Centre

Scanbalt

Latvian Health
Tourism Cluster

LATVIA

LITHUANIA

Vilnius University

POLAND

Interreg
Baltic Sea Region

The Municipality
of Lublin City

Upper Silesian Agency
for Entrepreneurship and Development

EUROPEAN
REGIONAL
DEVELOPMENT
FUND

EUROPEAN UNION

SKÅNE

Living Lab: Innovation Skåne

🌐 http://www.innovationskane.com/test-and-evaluation-support/

📍 GEOGRAPHICAL OPERATING AREA: Southern part of Sweden

👤 AUTHORS: Fred Kjelsson & Karolina Andersson

"

Innovation Skåne provides test and evaluation support to companies within the health and health care domain. We provide access to healthcare personnel for co-creation, testing and development of your solutions.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Innovation Skåne AB is the Innovation company of and fully owned by Region Skåne, the County Council of the southernmost county in Sweden, a county with approximately 1.4 million inhabitants. Region Skåne is responsible for the public healthcare system and regional economic development, including e.g. innovation and growth, regional infrastructure, digitalisation, culture and public transportation. Innovation Skåne's goal is to contribute to the future welfare services and regional growth through innovation. We offer innovation management expertise and support to Region Skåne and its employees, run growth projects in industries where Skåne has strong capabilities and there is international growth potential, and help entrepreneurs and start-up companies in Skåne with business advice. Innovation Skåne's innovation support focuses on five main areas: Health, Mobility, Materials, Lighting and Foodtech. Innovation Skåne has a successful history with start-tups, entrepreneurs, initiation and management of projects for the development of new methods for growth and with industry collaborations in our various industries.

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- **Karolina Andersson PhD. Innovation Manager.** karolina.andersson@innovationskane.com

LIVING LAB DESCRIPTION

Innovation Skåne works with Region Skåne's healthcare to create value for patients and employees through innovation. These include change management and how new innovative technologies can be used in healthcare, and the introduction of digital solutions, in order to improve Region Skåne's ability to innovate or improve its capacity to scale and/or stimulate for new innovations, this through work with guidelines for handling personal data, procurement strategies and innovation procurement as well as innovation methodologies, such as need and impact analysis, service design, policy labs and system transformation, as well as testbed and Living lab. Innovation Skåne also works with Skåne's municipalities and their need for innovation.

Innovation Skåne have more than 40 employees who are passionate about entrepreneurship, growth and social benefits. In our testbed and Living Lab we offer testing access and valuable contacts and insights through extensive inputs in health care and care players and to various professionals in the Region of Skåne, in Skåne municipalities and in private healthcare and care companies.

- Collaboration with innovation and digitization projects in Region Skåne, led by healthcare professionals employed by Innovation Skåne
- Network with national and international contacts and skills from researchers and companies of great importance for the digital transition of health, healthcare, care and entrepreneurship and start-up activities. -Contacts in other local areas of strength such as the mobile industry, research in diabetes, cancer diagnostics, smart materials, foodtech, lighting and mobility.

9	3	1	0
(9) HIGH RELEVANCE	**(3) MEDIUM RELEVANCE**	**(1) WEAK RELEVANCE**	**(0) NON-RELEVANT**

LIVING LAB BUSINESS MODEL NOW

BM ELEMENTS	LIVING LAB BUSINESS MODEL ATTRIBUTES						
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LIVING LAB BUSINESS MODEL FOR 2021

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Evaluating a Danish suicide-prevention soluti-on for possible entry into the Swedish market

MinPlan, a Danish SME that wanted to get insights into the requirements and possibilities of the Swedish system, through evaluating their solution together with the ProVaHealth partner Innovation Skåne. The evaluation included an overview of the suicide prevention system and how the structure is set-up in Skåne, and a usability workshop with participants from the primary care, psychiatry, child psychiatry in order to identify development and modification needs for the Skåne regional market.

END-USER TARGET GROUP:

The regional suicide prevention strategist, and participants from the primary care, psychiatry, and child psychiatry.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

In order to get the overview of the suicide prevention system and how the structure is set-up in Skåne, a meeting and interview was performed involving the regional suicide prevention strategist. The current strategy was discussed. A usability workshop was prepared and carried out in order to identify development and modification needs of the solution suitable for the Skåne regional market. During the workshop MinPlan briefly described their history and the product before the participants from primary care, psychiatry, child psychiatry were asked to create user personas and modify this according to the persona description in one of the smartphones that were available for testing. Afterwards, the participants were asked for feedback from a SWOT-perspective especially from a Skåne healthcare viewpoint. This feedback was collected for development purposes.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

MinPlan received concrete evidence of their products fit for market possibilities in the Skåne healthcare, and insight into product improvement possibilities and necessities for a successful entry into the Swedish market. End user benefit were the possibility of improved market knowledge about possible products.
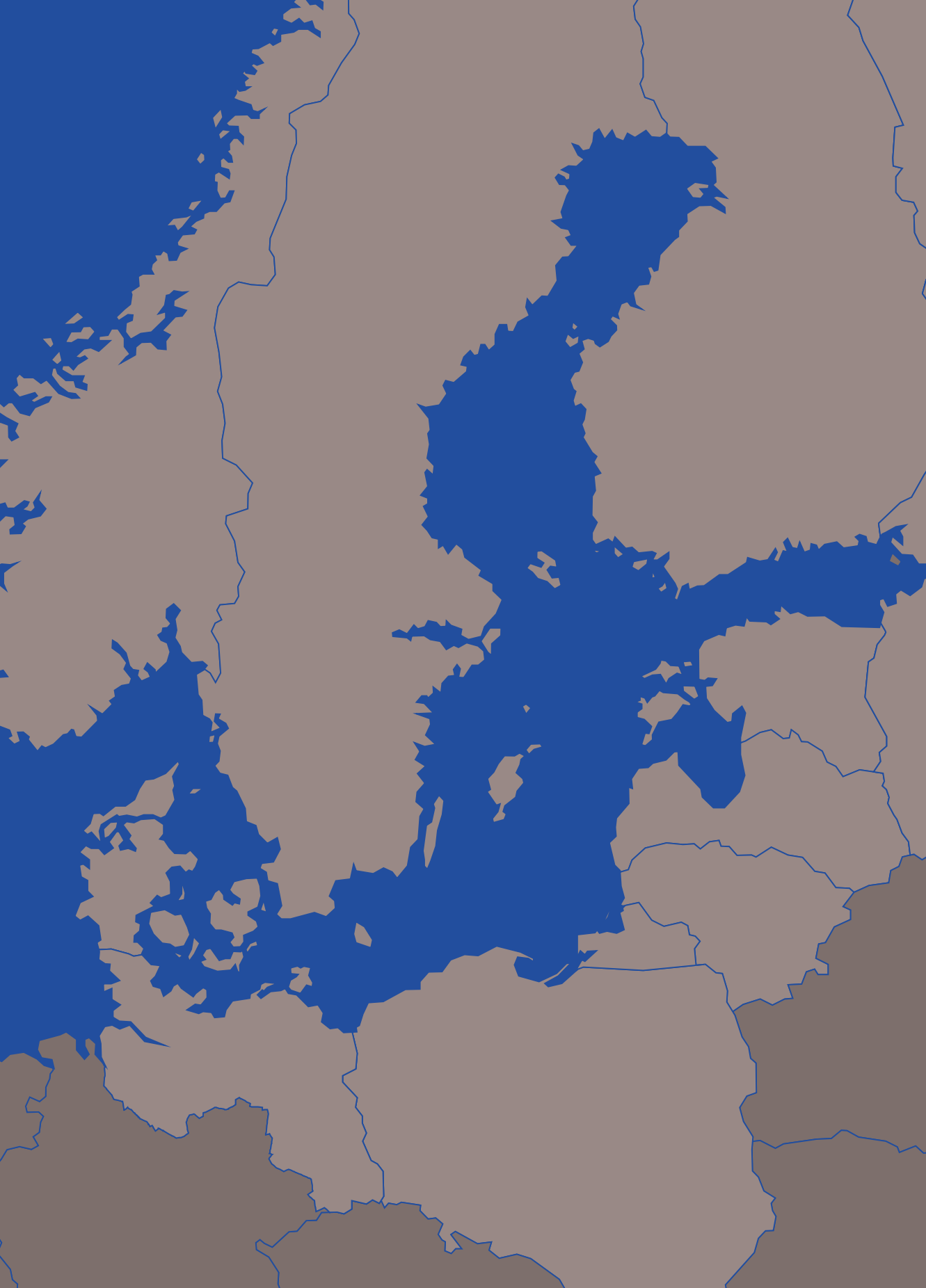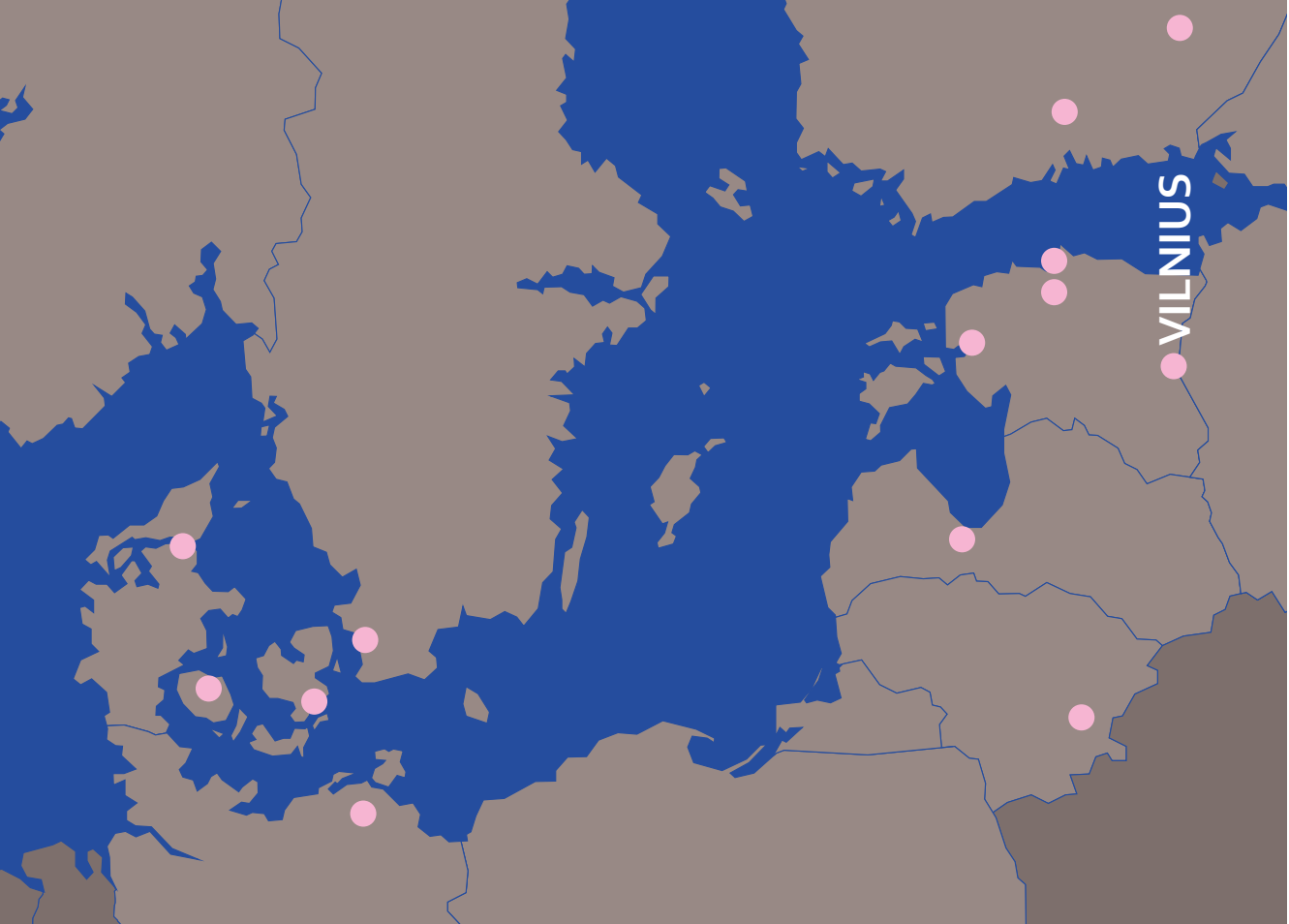
VILNIUS

Life Sciences Center

Living Lab: Vilnius University Life Sciences Center

🌐 https://www.gmc.vu.lt/en/open-access-r-d-center

📍 GEOGRAPHICAL OPERATING AREA: Vilnius, Lithuania Remote services worldwide.

👤 AUTHOR: Dr. Monika Baškytė

> *The mission of Life Sciences Center – serve as a hub for creating and fostering life sciences ecosystem at Vilnius University and Lithuania by offering an internationally competitive research and study programmes to nurture a new generation of research-es and innovators competitive in a global world.*

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Vilnius University (VU) is the largest Lithuanian education and scientific institution. Research in Life and Health Sciences at VU is carried out in the Life Sciences Center.

VU Life Sciences Center consists of three institutes:
- Institute of Biochemistry
- Institute of Biosciences
- Institute of Biotechnology

Research topics and laboratories in the Life Sciences Center, which operates under open access:
- gene editing technologies, like CRISPR Cas;
- nucleic acid and protein technologies, molecular diagnostics;
- drug design;
- droplet microfluidics technology;
- next generation epigenomics;
- biocatalyzers;
- lipid systems and membrane proteins;
- brain studies.

Strategic Priorities:
- Become an integral part of European Life Sciences community: conduct research and develop study pr
- grams competitive at the international level.
- Enhance Lithuania's potential in Life Sciences: contribute to creation of life sciences ecosystem.
- Motivate Life Sciences Center community: improve research and study environment.

LIVING LAB CORE TEAM MEMBERS
- Director Dr. Gintaras Valinčius, gintaras.valincius@gmc.vu.lt
- Director of Insitute of Biochemistry Dr. Kastis Krikštopaitis, kastis.krikstopaitis@bchi.vu.lt
- Director of Insitute of Biosciences Prof. Juozas Rimantas Lazutka, juozas.lazutka@gf.vu.lt
- Director of Insitute of Biotechnology Prof. Saulius Klimašauskas, saulius.klimasauskas@bti.vu.lt
- Deputy director Dr. Rokas Abraitis, rokas.abraitis@gmc.vu.lt

LIVING LAB DESCRIPTION

Vilnius University Life Sciences Center (VU LSC) main infrastructure and services:

- Mass spectrometers and liquid chromatographers systems for proteomics analysis (MALDI TOF/TOF, Qt-rap4000, Higher Definition Mass Spectrometer Synapt G2)
- Sample preparation kits
- Thin film deposition system, KJLC PVD 75, Kurt J. Lesker Company LtD
- Surface plasmone resonanse biosensor combined with potentiostat SPR Twingle, Metrohm Autolab
- Spin coater, WS-650-23NPP, Laurell
- Langmuir-Blodgett deposition trough, KSV NIMA Small, Biolin Scientific
- Contact angle measuring system EasyDrop, Kruss GMBH
- Vertical micropipette puller, P-30 Sutter Instrument
- Atomic force microscope, Dimension Icon, Bruker AXS
- Raman microscope system, LabRam HR800, Horiba Jobin Yvon
- UV and visible wavelength region diode pumped solid state laser, NT242-SH/SFG/DUV-SCU, EKSPLA
- 266 nm continuous wave solid state laser, FQCW-266-100, CryLas GmbH
- 405 nm continuous wave diode laser, DL 405-040-SO, CrystaLaser
- 457 nm and 532 nm continuous wave solid state lasers, Cobolt AB
- Genetic Analyser 3130xl
- Liquid chromatography mass detector Agilent 6410 Triple Quadrupole
- Eppendorf centrifuga 5424
- Laminair safety cabinet ESCO
- Bioreactor
- System for crystal growth and observation
- X-ray diffractometer for macromolecular and chemical crystallography.
- High capacity PCR preparation and dispensing system QIAgility
- Liquid chromatography system „AKTA AVANT 25"
- Platform for a high throughput analysis of bacterial pathogens
- Electroencephalograph
- Computerized psychological test kit
- Visual stimulus generator
- Eye movement recording device
- Equipment for evaluation of hormone concentration in saliva
- Equipment for isothermal titration calorimetry and quantitative Real-time amplifyer
- Fermentator for biomass
- Crystals and crystallization
- X-ray crystallography, structural biology, atomic structure determination, bioinformatics, absolute configuration
- Chromatography and nucleic acids
- DNA platform, PCR, genotyping, electrophoresis, plasmids, eukaryotic cells, pathogens
- Electroencephalograph, electrical signals, brain
- Psychological test, response registrator
- Platform for a high throughput analysis of bacterial pathogens
- Automated cell image analysis platform Evos FL

9	3	1	0
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LIVING LAB BUSINESS MODEL NOW

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Life Sciences Center

New drug substances with unique anti-inflammatory activity for ophthalmic indications.

The objective of the test was to design of anti-inflammatory effect testing in vivo using laboratory rats to develop new drug substances for ophthalmic indications. Vilnius University Life Sciences Center provided this service for Experimentica Ltd. (Finland), which is a contract research organization dedicated to developing and offering novel preclinical ocular models and services to clients in the pharmaceutical, biotech and academic sectors.

END-USER TARGET GROUP:

The concept of Experimentica Ltd. is to bridge a gap between the development of novel in vitro, ex vivo and in vivo ocular models and their use in developing clinical applications as well as to draw upon academic knowledge in a contract based organization

LIVING LAB ENVIRONMENT AND ACTIVITIES:

Laboratory rats up to 6 weeks were used for the testing of new substances anti-inflammatory effect. After the testing process, statistical analysis of the test data was performed and a report with the analysis and insights was provided.

BENEFITS OR OUTCOME OF THE PROJECT:

Tested new drug substances with unique anti-inflammatory activity for ophthalmic indications would further enter the preclinical development pipeline within pharmaceutical industry.
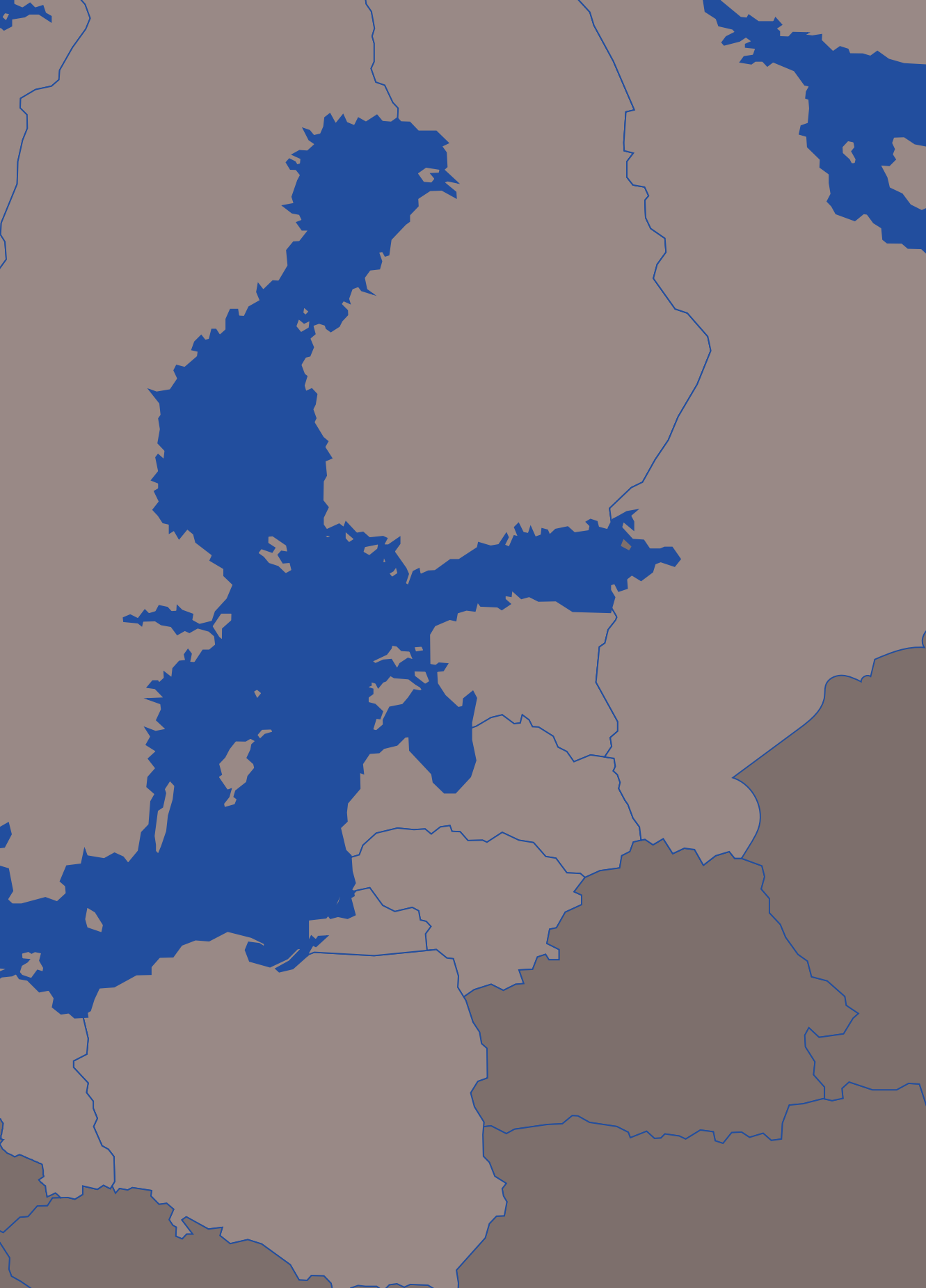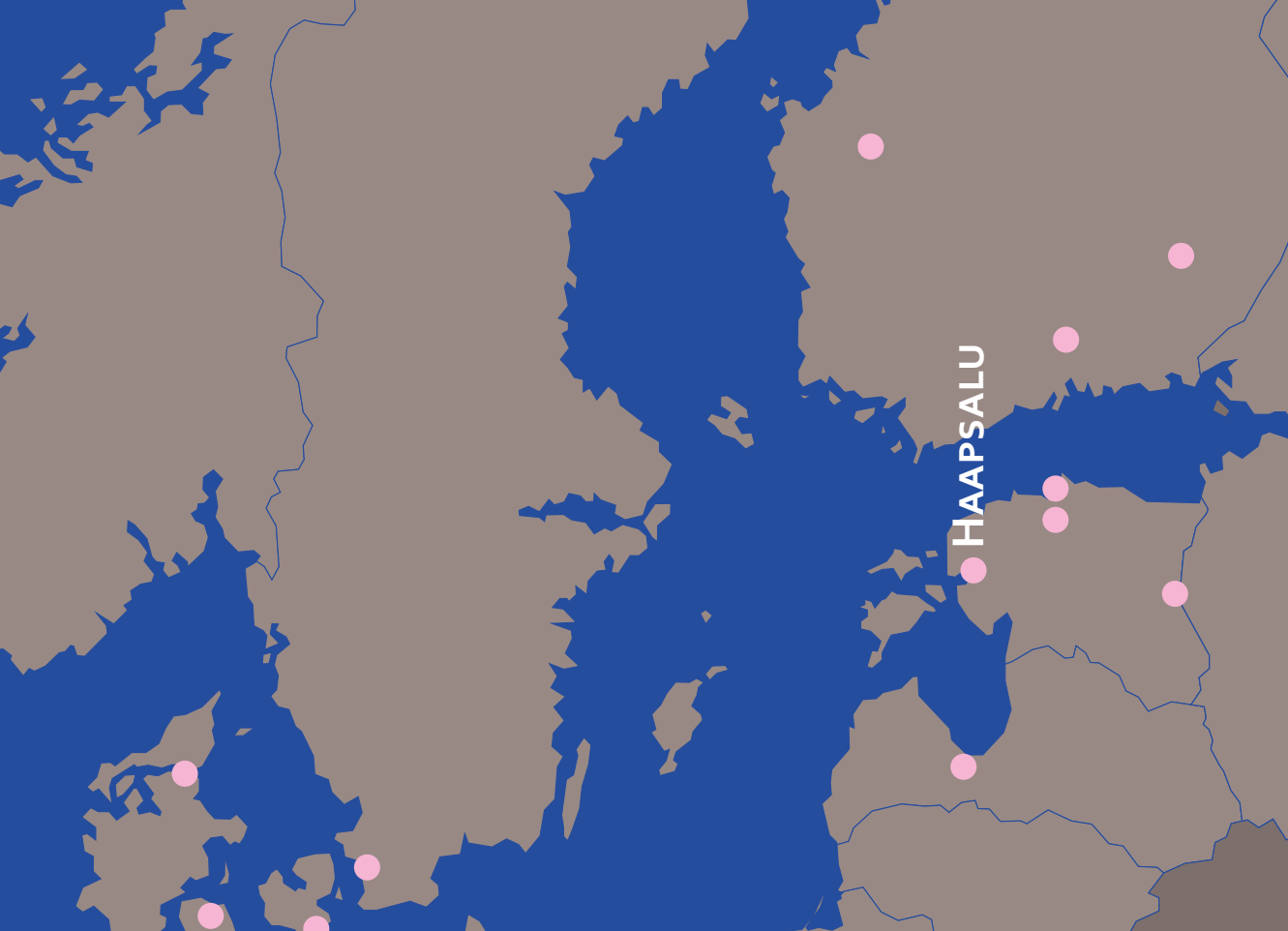
HAAPSALU

Haapsalu Neurological Rehabilitation Centre

Living Lab: Haapsalu Neurological Rehabilitation Centre

🌐 www.hnrk.ee

📍 GEOGRAPHICAL OPERATING AREA: Estonia, Läänemaa, Haapsalu

👤 AUTHORS: Maire Nigul & Kadri Englas

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> *Haapsalu Neurological Rehabilitation Centre (HNRC) LL has extensive experience, an enthusiastic team with a contemporary knowledge base, and modern equipment and facilities that are all effectively employed to provide high-quality, evidence-based, client-centered and comprehensive LL services, serving the best interests of our clients and partners.*

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

HNRC is a hospital that focuses on providing rehabilitation services for children and adults with neurological disorders. Most of the hospital's patients are people with spinal cord and brain injuries, but we also treat patients with progressive nervous system diseases, multiple traumas and congenital developmental disabilities.

HNRC in numbers:
- Founded in 1958
- 102 dedicated rehabilitation beds (around 1/3 of Estonia's inpatient rehabilitation)
- 150 staff members
- Hospital covers 6145,6 m², over 1000 m² of which are dedicated to active treatments
- The main funder of HNRC's services is the Estonian Health Insurance Fund
- HNRC has three major developmental structures: Clinical Gait Lab, Neuro-robotics laboratory (in co-operation with Centre of Excellence in Health Promotion and Rehabilitation), Adaptive Device Centre
- Official language is Estonian, but English and Russian are not a problem while service provision.

In our hospital we are treating around 4000 cases in year. In addition to its everyday hospital work, HNRC also serves as a practical training base for young specialists and is a reliable partner in various research and development projects.

LIVING LAB CORE TEAM MEMBERS

Kadri Englas - chairman of the board. E-mail: kadri.englas@hnrk.ee.

- Kadri Englas is a pediatric physiotherapist with 12 years of experience in neurorehabilitation. Her administrative responsibilities have been connected with development and quality work in a neuro-rehabilitation centre. At the moment she is CEO for HNRC. Also, she is PhD student in the University of Otago, Wellington. In HNRC's Living Lab she does preparatory work: choosing partners, understanding the needs of them and putting together the offers, proposing possible solutions within HNRC to find answers for partners' questions.

Maire Nigul – quality specialist. E-mail: maire.nigul@hnrk.ee.

- Maire Nigul has worked in quality, processes coordinating and project management field 14 years in various industrial and service sectors. At the moment she is quality specialist in HNRC. In HNRC's Living Lab she coordinates planning of tests and conducting the testing processes, also is responsible for communication with partners during the testing process.

LIVING LAB DESCRIPTION

The main services of HNRC LivingLab is providing:

1. Consultations in conceptualization phase of development of a rehabilitation related product or service to provide ideas for solving end users' problems.
2. Consultations and testing for proof of concept in rehabilitation related product or service development to demonstrate its promised and expected functions.
3. Consultations and tests in rehabilitation equipment prototype creation.
4. Consultations in development of various therapy and testing methods within rehabilitation.
5. Testing prototypes of rehabilitation equipment, IT-solutions, orthosis, aids for moving or for everyday activities.
6. Validation of products - establishing evidence that a product, procedure, process or testing methods also works as it is intended to outside the test environment in contact with real end-users and stakeholders.

The quality of LL service we can provide in high level because we have:

1. Knowhow and long-term experiences in neurological diseases treatment and in usage top- level equipment.
2. Patients with wide range of different diagnosis, the intensive patients flow.
3. Experiences in scientist work at different projects.
4. Top technological basis (like Clinical Gait Lab, Neuro-robotics laboratory, Adaptive Device Centre)

HNRC LL has today several experiences in tests of prototypes and final-products, also in consultations of product or service development.

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Haapsalu Neurological Rehabilitation Centre

HNRC has developed and provided the transnational LL services for the SME-s for last 2 years.

During the project we collaborated with Custom 3D Tech Ltd (WIDE) in Latvia and with Sanoste OY in Finland. Working with WIDE we found solutions to design more elegant ankle foot orthoses (AFO-s) while lowering the price, minimizing the amount of handiwork for the orthosis specialist and maximally meeting expectations of client. In co-operation with Sanoste we tested the possibilities to use the digital training solution for increasing patients motivation to perform at home the physical exercises suggested by the therapist.

END-USER TARGET GROUP:

To WIDE we created the product for children and adults with a different neurological diseases and traumas to support their ankle functions. For Sanoste solution the main target group would be hospitals and welfare institutions to help their adult clients to preserve their physical capability

LIVING LAB ENVIRONMENT AND ACTIVITIES:

During the LL testing process and activities we aimed to solve next issues:
- better understanding the overall usability of the product or process - proof of concept;
- tested functionality of product or process in different live settings and situations;
- more information about specific usability of the product;
- understanding user´s ratings and feedback about the product usability.

In testing process we followed next steps:
1. Planning: specifying of testing item; identification of testing group of patients; recruitment of testing team; consultations for testing item development; set up criteria for the product to meet end-user needs; create in co-operation with client (SME) the testing process and time schedule.
2. Conduct test: technical and practical readiness to start with tests; consultations, proposals and support to product improvement during testing period; testing activities; collecting feedback from involved specialists and end-users.
3. Closure and follow up: the general summary.

BENEFITS OR OUTCOME OF THE PROJECT:

- Resulting of tests during 1,5 years together with Custom 3D Tech Ltd the AFO as new product was added to the SME´s product catalogue.
- Resulting of 3 months tests and feedback collection period for Sanoste OY we created together the better working and usable solution for specified target group.
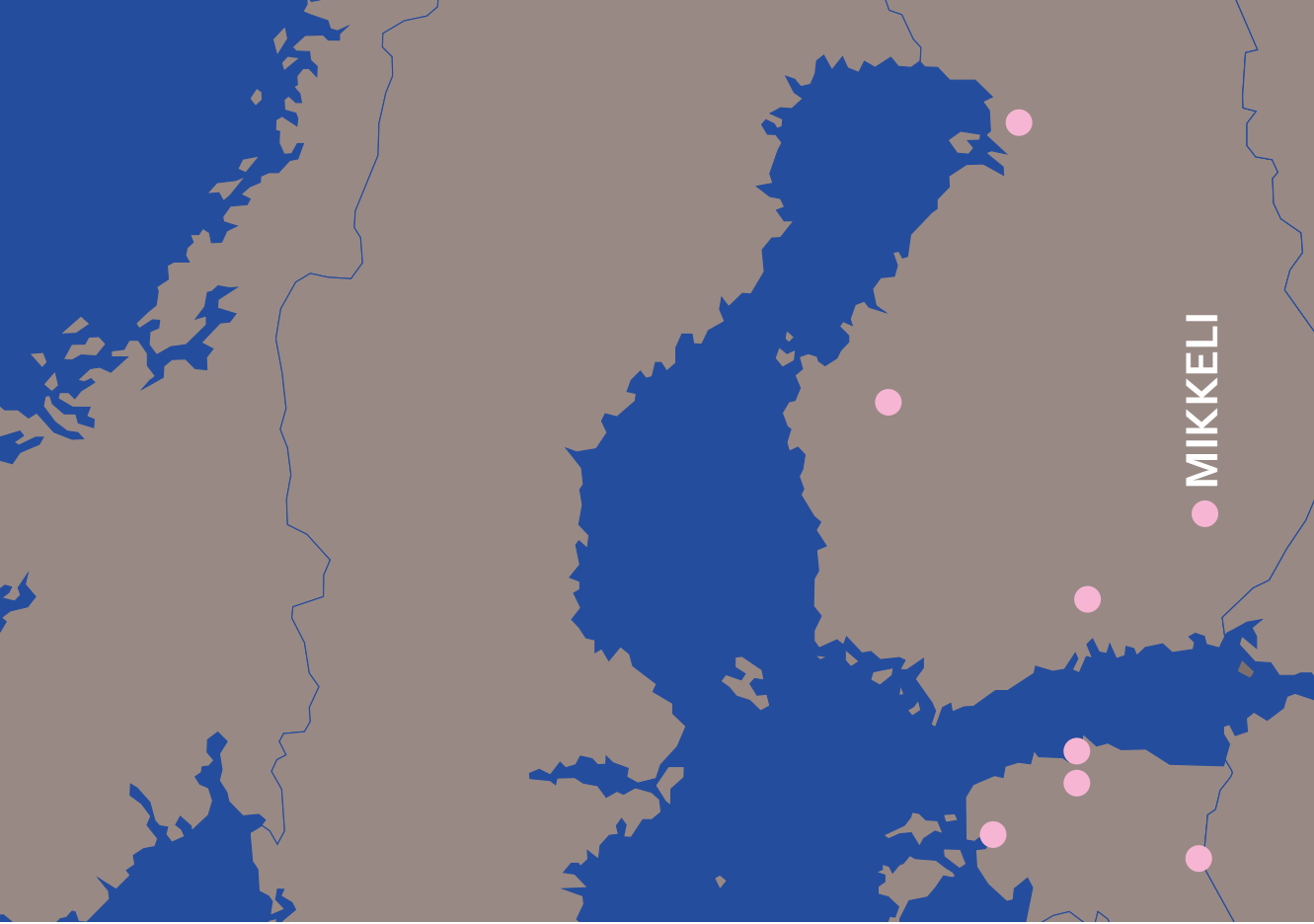
MIKKELI

XAMK

Small Business Center

Xamk Active Life Lab

🌐 https://www.xamk.fi/en/rdi/active-life-lab/

📍 GEOGRAPHICAL OPERATING AREA: Finland, Southern Savonia, Mikkeli

👤 AUTHOR: Viljo Kuuluvainen

"

Active Life Lab's mission is to increase people's health through effective wellbeing services. We carry out our mission by systematically gathering information on the effectiveness of wellbeing services, conducting cutting-edge research to develop services, and applying this knowledge in practice with our partners. Research and development projects form the foundation of our activities.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

South-Eastern Finland University of Applied Sciences – Xamk – is an institute of higher education which focuses on

- wellbeing,
- technology and
- creative industries.

Xamk is the 5th largest university of applied sciences in Finland. We provide education in eight fields of study, participate in research and development and provide services to the businesses and residents of the area. There are campuses in four towns: Kotka, Kouvola, Mikkeli and Savonlinna.

International cooperation is an important part of our profile, with more than 350 partner educational institutions around the globe.

Xamk is a strong implementer of RDI activities and it is currently Finland's largest UAS in the field of RDI, based on external financing alone. There are over 170 ongoing projects annually, in which our experts find, test and develop new products and services, or conduct research for future needs.

Facts about Xamk
- 9400 students
- 750 employees
- 1700 graduates per year
- 62 Bachelor's programmes
- 27 Master's programmes
- 4 campuses
- 350 partner institutions around the world
- Region of operations: Southern Savonia and Kymenlaakso
- Second largest UAS in Finland in terms of budget; annual turnover EUR 70 million
- Extensive RDI activities
- Versatile services

LIVING LAB CORE TEAM MEMBERS

Active Life Lab team includes around 15 professionals – all with their own field of expertise e.g. spots and health sciences, physiotherapy, IT development and business development.

- **Viljo Kuuluvainen, RDI specialist, viljo.kuuluvainen@xamk.fi, MSc (econ) & MSc (sport sciences)**
- **Arto Pesola, Research manager, arto.pesola@xamk.fi , Phd (exercise physiology)**

LIVING LAB DESCRIPTION

Active Life Lab is a research and development unit of the South-Eastern Finland University of Applied Sciences, which works in the premises of Saimaa Stadium, established in 2018 in Mikkeli.

Our mission is to increase people's health through effective wellbeing services. We carry out our mission by systematically gathering information on the effectiveness of wellbeing services, conducting cutting-edge research to develop services, and applying this knowledge in practice with our partners. Research and development projects form the foundation of our activities. Besides, Active Life Lab offers expert services in cooperation with partners and serves as a learning environment for Xamk students.

The facilities of Active Life Lab offer possibilities to measure the effectiveness of activities targeted to improve human wellbeing. The information provided by the variety of indicators can be used to find out how the effectiveness of the activities varies in different customer groups. The information can be used for target activities for the customers, who will get the most benefits from them. The information collected will help companies to develop new solutions that have a measured impact on human wellbeing.

Our projects

FREERIDE: Are there free tickets? Children's independence and equality in mobility and physical activity following a free bus ride –experiment in the city of Mikkeli
- Funding: Ministry of Education, Science and Culture
- Partners: Aalto University, Department of Built Environment

CogTail: Tailored Games for Cognition & Force Developments In Elderly Care
- Funding: Business Finland

WellmiePRO – Wellbeing service effectiveness platform
- Funding: European Regional Development Fund

CARVE: Circadian Activity Revitalizing Vocational Energy
- Funding: European Social Fund
- Partners: KU Leuven University (Belgium), Idein Ltd. research institute (Bulgaria)

9	3	1	0
(9) HIGH RELEVANCE	(3) MEDIUM RELEVANCE	(1) WEAK RELEVANCE	(0) NON-RELEVANT

LIVING LAB BUSINESS MODEL NOW

BM ELEMENTS	LIVING LAB BUSINESS MODEL ATTRIBUTES						
KEY PARTNERS	Research org.	Regional public org.	Municipals and cities	Networks and Clusters	State level org.	Digital service providers	NGOs, and third sector org.
	Education org.	Secondary care org.	Device manufacturers	Tertiary care org.	Primary care org.	Preventive health / wellbeing service providers	
KEY ACTIVITIES	Project mgmt.	Testing and co-creation	Funding support services	Marketing and sales	End-user services	Support services to state authorities	
	Education and training	Ecosystem orchestration	Support services to regional authorities	Support services to local authorities	Funding		
KEY RESOURCES	Personnel	Infra and technologies	Partner(s)	External networks	User and patients panel	Students	Data and publication databases	External experts	IPR-portfolio
VALUE PROPOSITIONS	R&D Services	With real end-user	Customized services	Ecosystem and project mgmt.	Funding support	Method development	Funding
	Unique infrastructure	Various positive arguments	Multi-disciplinary	Value and impact evaluation	Education and training	Marketing Support	
CUSTOMER RELATIONSHIPS	Long-term relations	Project based	Direct personal contacts	Networking	Events	Internal	Co-Creation with various stakeholders	Steering	Advisory
CHANNELS	Co-operation projects	Regional channel	Educational channels	Events arranged by LL	Professional publications	Scientific publications	Online, mobile and social media	Paid media and marketing
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REVENUE STREAMS	Project grants	Fixed or permanent funding	R&D project and consulting service sales	Education and training services	Device and infrastructure rental	Donations	Royalties	Event and site visit fees	Equipment and device retail

LIVING LAB BUSINESS MODEL FOR 2021

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This section will briefly introduce a Living Lab case

Small Business Center

Yolife mobile app user experience test

The objective of the test was to gain end-user insight and experiences about the Yolife app during a 2-week usage. The collected data is used for further development of the app and for other possible business development and marketing purposes.

END-USER TARGET GROUP:

The target group for the test was selected from the Active Life Lab testing register. The register consists of end-users who have participated in previous research. Based on Yolife's own target groups, preferences and expectations the selection criteria for the target group was:

- Age 18-65
- Status: employee or student
- Both genders

LIVING LAB ENVIRONMENT AND ACTIVITIES:

- The test protocol and the research questionnaires were designed by Active Life Lab. The protocol was reviewed and approved by Yolife.
- The app was tested by real end-users in Mikkeli region in Finland. The data was collected by online questionnaires (1&2).
- Both questionnaires consisted of three sections. The questionnaire included multiple choice and open questions.
- 1. Background questions 2. Questions about Yolife app 3. Perceived impact of using Yolife (MARS, Mobile App Rating Scale Section F)
- The protocol was piloted by Active Life Lab staff before starting the actual test.

The results of the two questionnaires were analyzed as individual entities. Although part of the respondents in both questionnaires could have been linked based on their e-mail addresses, most remained unidentified. Therefore, we performed only within time-point comparisons. The open question responses were classified and summarized. The MARS responses were analyzed using Microsoft Office Excel.

BENEFITS OR OUTCOME OF THE PROJECT:

The test provided Yolife valuable and detailed information about the app from real end-users. This analyzed data and the conclusions drawn by Active Life Lab specialists can be used for further development of the mobile app and the company's business model.

SEINÄJOKI

SeAMK

SEINÄJOEN AMMATTIKORKEAKOULU
SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

SeAMK Telemedicine Center

www.seamk.fi

GEOGRAPHICAL OPERATING AREA: Finland, South-Ostrobothnia, Seinäjoki

AUTHORS: Elina Leppäkangas & Sami Perälä

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SeAMK conducts research, development and innovation (RDI) with a distinctly practical emphasis, serving teaching and supporting industrial small and medium enterprises (SME) and service production within the region.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Seinäjoki University of Applied Sciences is a multidisciplinary institution of higher education and an efficient actor in education and research, development and innovation (RDI) in the region of South Ostrobothnia in West Finland. SeAMK conducts research, development and innovation (RDI) with a distinctly practical emphasis, serving teaching and supporting industrial small and medium enterprises (SME) and service production within the region. RDI is carried out in co-operation with regional and national enterprises and organizations.

LIVING LAB CORE TEAM MEMBERS

- **Sami Perälä, Development Manager of Well-being Technologies. MSc, sami.perala@seamk.fi, Developing Well Being Technology in Seinäjoki University of Applied Sciences (SeAMK). He has degree in nursing. He is a qualified teacher in vocational education and has a degree in professional development in management. He worked in EPTEK as an expert for 7 years and as a CEO for 12 years. He was the locomotive for South Ostrobothnia becoming one of the first eHealth regions in Europe. He has experience in different projects in local/national and international level.**

- **Elina Leppäkangas, Project manager. BBA, elina.leppakangas@seamk.fi. Project manager tasks. Planning new project ideas and being part of the writing team.**

- **Jouko Lakaniemi, RDI Specialist, jouko.lakaniemi@seamk.fi, Research, development and innovation in the field of wellbeing technology. Development and maintaining of technologies in Telemedicine Center, Welfare robotics and AI Lab.**

- **Arttu Mustajärvi, RDI Specialist, arttu.mustajarvi@seamk.fi, Research, development and innovation in the field of wellbeing technology. Development and maintaining of technologies in Telemedicine Center and Simlab, projects for IT administrations.**

- **Jaana Vainionpää, Project manager, MSc, jaana.vainionpaa@seamk.fi, She worked as a paramedic in Oulu region and with Oulu university hospital as a nurse anesthetist and as a staff nurse. Past years Jaana has been working with Seinäjoki University of applied Sciences as a project manager, concentrating on Well-being technologies, Artificial Intelligence, service robots and mobile health solutions.**

- **Merja Hoffrén-Mikkola, Principal lecturer, (Wellbeing technology and health promotion), PhD, merja.hoffren-mikkola@seamk.fi Current duties include teaching, RDI-projects and unit development tasks. In big picture all these tasks are related to wellbeing technologies and/or health promotion. She teaches both lower and higher education students and supervise Theses. Her background is in sport sciences (PhD, biomechanics) and thereafter I have worked with athletes in training center and in wearable technology development.**

- **Mari Salminen-Tuomaala, Principal lecturer, PhD, mari.salminen-tuomaala@seamk.fi, RDI-projects. She has worked over 20 years as nurse at medical departments, cardiac care unit and emergency department before teaching career. Her main research and expertise areas concern acute care (intensive care, out-of-hospital emergency care, care and counseling at the emergency department), simulation based education, psychosocial coping of myocardial infarction patients and their spouses.**

LIVING LAB DESCRIPTION

One of the SeAMK´s focus point is health and wellbeing technology and SeAMK is investing on it. SeAMK Telemedicine Center is one-step for that direction. SeAMK Telemedicine Center is a home like environment where you can explore different kind of assisted living technologies and eHealth products provided by various companies. The center provides information about the assisted living solutions for example to elderly people and caretakers as well as to social and health care professionals and students.

We are also working close with The Hospital District of South Ostrobothnia so it gives us possibilities to use their professional support from the different fields. We can introduce products/services for right persons at hospital district and South Ostrobothnia area because of our wide cooperation network.

We offer consultation services and can arrange group of professionals and end users for testing and piloting purposes. Our team is very flexible and over the years, we have gathered a good and broad experience from the field of eHealth and telemedicine (for 20 years). We have arranged different pilots e.g. wound treatment pilot, distance consultation pilot and gathered the test group for a mobile application etc.

9	3	1	0

LIVING LAB BUSINESS MODEL NOW

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LIVING LAB BUSINESS MODEL FOR 2021

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SeAMK

SEINÄJOEN AMMATTIKORKEAKOULU
SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

Professional support for the development of the training software for the AR-glasses.

The company was interested in getting feedback on how the simulation training/situations were carried out at the moment and hopes for the future implementation of the training.

END-USER TARGET GROUP:

- Last year nurse students and acute care teachers.
- Healthcare professionals.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

AR software for decision-training in stressful situations that will optimize basic education and simulation training for emergency personnel. The company was interested in getting feedback on how the simulation training/situations were carried out and hopes for the future training.

Our project team formulated a questionnaire together with the company representative. The questionnaire were distributed for one student group and a couple of teachers teaching acute care. The answers were recorded to google drive from where the company could see the results

BENEFITS OR OUTCOME OF THE PROJECT:

Useful information, from the experience of the acute care training (simulations training) at the moment and needs/hopes for the future training, for the product development.
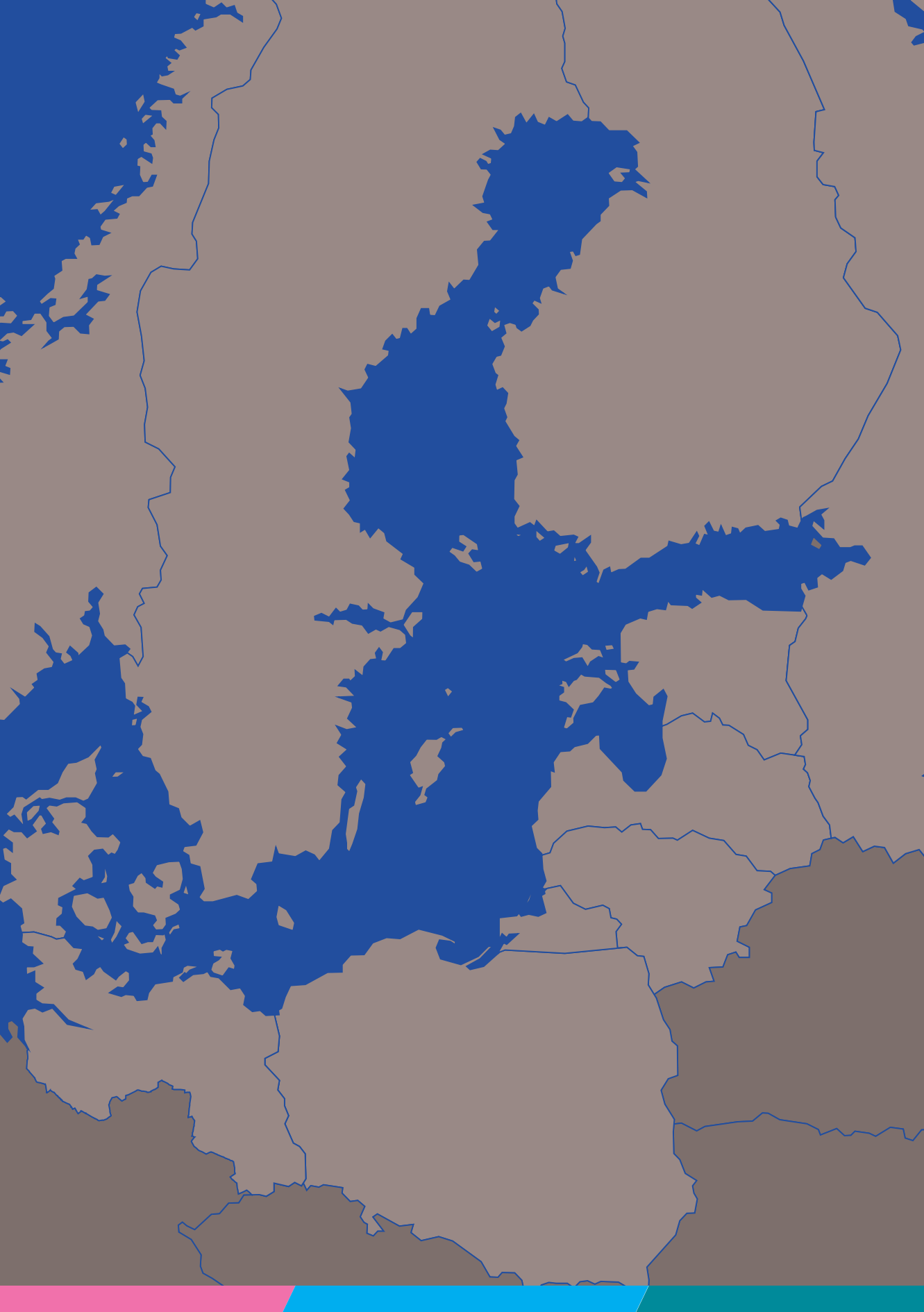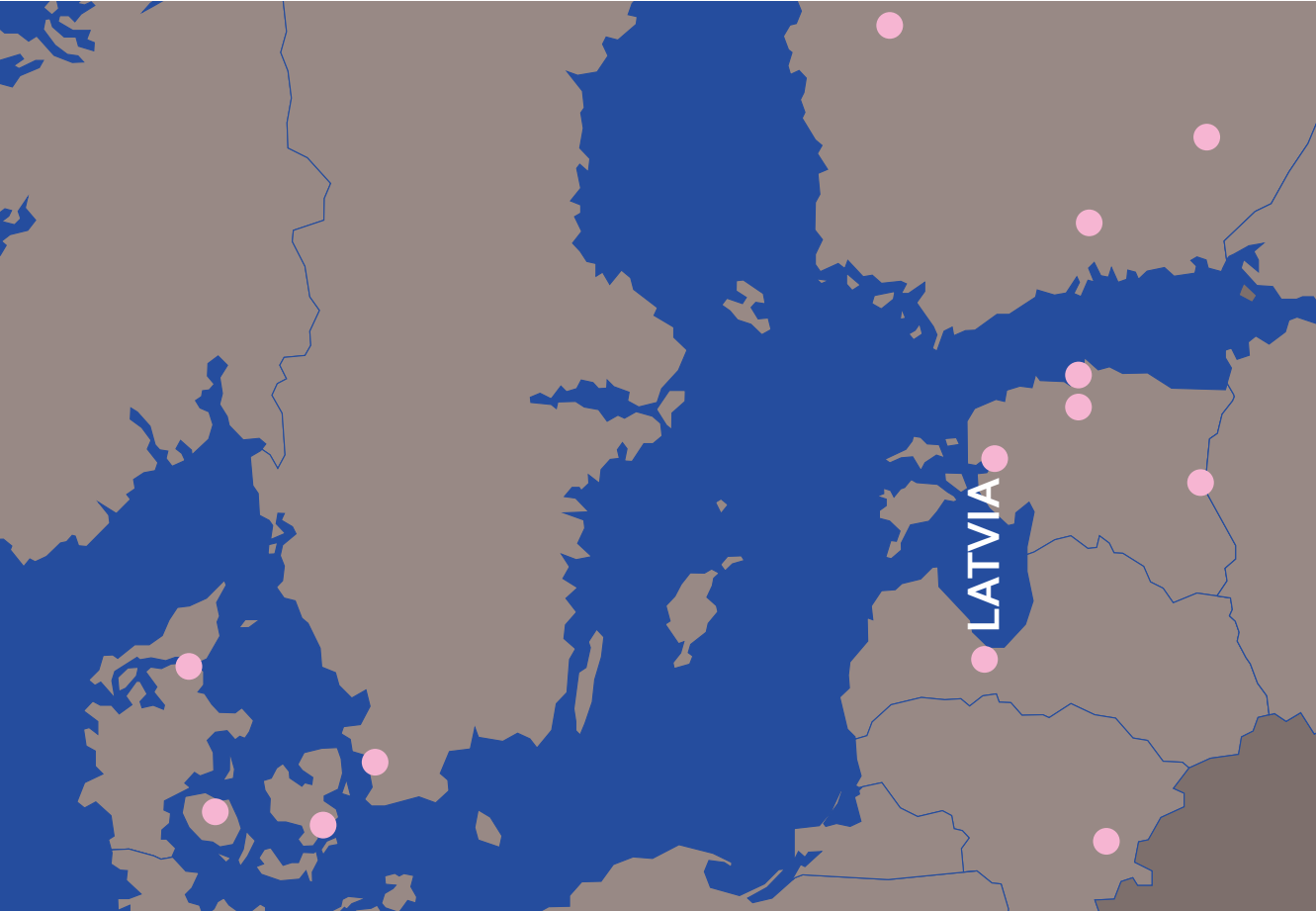
LATVIA

green land of health
latvian health tourism cluster

Latvian health tourism cluster

🌐 https://healthtravellatvia.lv/en/

📍 GEOGRAPHICAL OPERATING AREA: Latvia. Cities: Riga, Liepaja, Saulkrasti, Ventspils, Sigulda, Ligatne, Jurmala.

👨‍🏫 AUTHORS: Gunta Uspele & Anda Aleksandrova

"

LHTC includes 60 cluster members, wide variety of health providers: government, municipality and regional hospitals, private clinics, rehabilitation centers, resort hotels, educational and research institutions. We work together with national authorities – Ministry of Foreign Affairs, Ministry of Economics, Ministry of Health, Investment and Development Agency of Latvia and others.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Since 2012 Cluster (a group of companies and related institutions that closely collaborate within a certain area) works in different levels: fosters collaboration between members working in the health sector and national authorities, strategic cooperation regarding medical export issues with state and educational institutions, in research and product development, support of SME's and start-ups and have international cooperation with foreign clusters and Living labs.

LHTC's main priorities are: development of complex products in the sphere of health and — especially — medical tourism highlighting, for instance: Weight loss surgeries, Dermatology, Diagnostics, Childbirth, Aesthetic medicine, Gastroenterology, Gynaecology and urology, Internal medicine, Cardiology, Fertility treatment, Treatment of oncology diseases, Orthopedic, Otorhinolaryngology, Pediatrics, Plastic surgery, Vision, Rehabilitation, Reconstructive surgery, Vein treatment, SPA, Dentistry and others.

LIVING LAB CORE TEAM MEMBERS

Gunta Ušpele, head of cluster
Phone: +371 29214868, gunta@healthtravellatvia.lv
Work experience:
- Manager of Latvian Health Tourism Cluster/Now
- Deputy Chairman of Health Service Export Coordination Council, Ministry of Health/Now
- Deputy Chairman of Tourism Commission, Ministry of Economy
- Director of Tourism Department, Jurmala City Council
- Senior officer, Foreign Economy Division, Foreign Economy Department, Ministry of Foreign Affairs

LIVING LAB DESCRIPTION

The cluster gives an opportunity to improve cooperation among health sector providers, to organize common activities, to invent and market integrated, innovative products and services, and to make them more available to locals as well as foreign patients.

Main areas of the cluster activities:

- To implement marketing activities of the health tourism industry, of the medical export services, which would provide a significant increase of the export services
- To facilitate collaboration of the cluster partners in service providing;
- To collaborate with state institutions regarding implementation activities of Development Action Plan of healthcare export services 2019-2023 and Latvian medical export annual marketing plan: Ministry of health of the Republic of Latvia, Ministry of Foreign Affairs of the Republic of Latvia, Ministry of Economics, Latvian Investment and development Agency, Central Finance and Contracting Agency and others.
- To promote collaboration of the cluster operators and universities in order to ensure the compliance with the human resources requirements for the health industry;
- To develop cooperation links in research and development between the cluster members and scientific institutions in order to create new and innovative added value products and services, based on the unique Latvian nature capital;
- To represent the interests of the health tourism industry in drawing up the policy and development documents;
- To increase the the cluster capacity and to promote the international cooperation.

Main environments are mono and multi type clinics and hospitals which are our cluster members.

9	3	1	0
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green land of health
latvian health tourism cluster

Are you ready for export of medical treatment?

We identified clinics and treatments which are competitive or which provide unique services that are necessary for the Baltics. We integrated data of Latvian clinics to Medihub search engine and database so that patients from Latvia, Estonia and Finland have access and information about the best solution, doctor or clinic, and treatment.

END-USER TARGET GROUP:

A very wide range of users (from 25 - 75 years, men and women), we need to make sure that the website is accessible, immediately understandable and convenient to use for a wide range of users independent of their age, sex, nationality, medical condition, and level of computer skills.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

In the vision and planning phase, we identified all treatments and all clinics and hospitals whose services we will integrate into Medihub platform. In total we collected 47 profiles. Because of our Living Lab database and cluster members – we had possibility to collect and test this platform with many stakeholders, involving clinics, hospitals, SPA, doctors, nurses ect. We also translated all taxonomy and created Latvian version of this platform.

While putting data into the Medihub platform we identified problems and Medihub IT specialists created a totally new system and the data collection and linking now is done automatically by a computer algorithm based on how the particular service is called.

In Qualification and test phase main activities were to test if these solutions are easy to use for patients. We were giving users to test and send possible solutions for better and easier access. Again our database of biggest Latvian clinics and hospitals who have access to their patients helped to gain a lot of time and we could test this website with a wide range of patients.

BENEFITS OR OUTCOME OF THE PROJECT:

We covered all treatments and specified the strongest fields of each country. Fully finished website with the best possible treatments and prices for getting more patients to clinics in each country. With www.medi-hub.org, we get two benefits: for patients, it is very convenient to find treatments and doctors consultations for the best price and best availability. For clinics and doctors benefit is: more patients from abroad and increase the volume of export services.
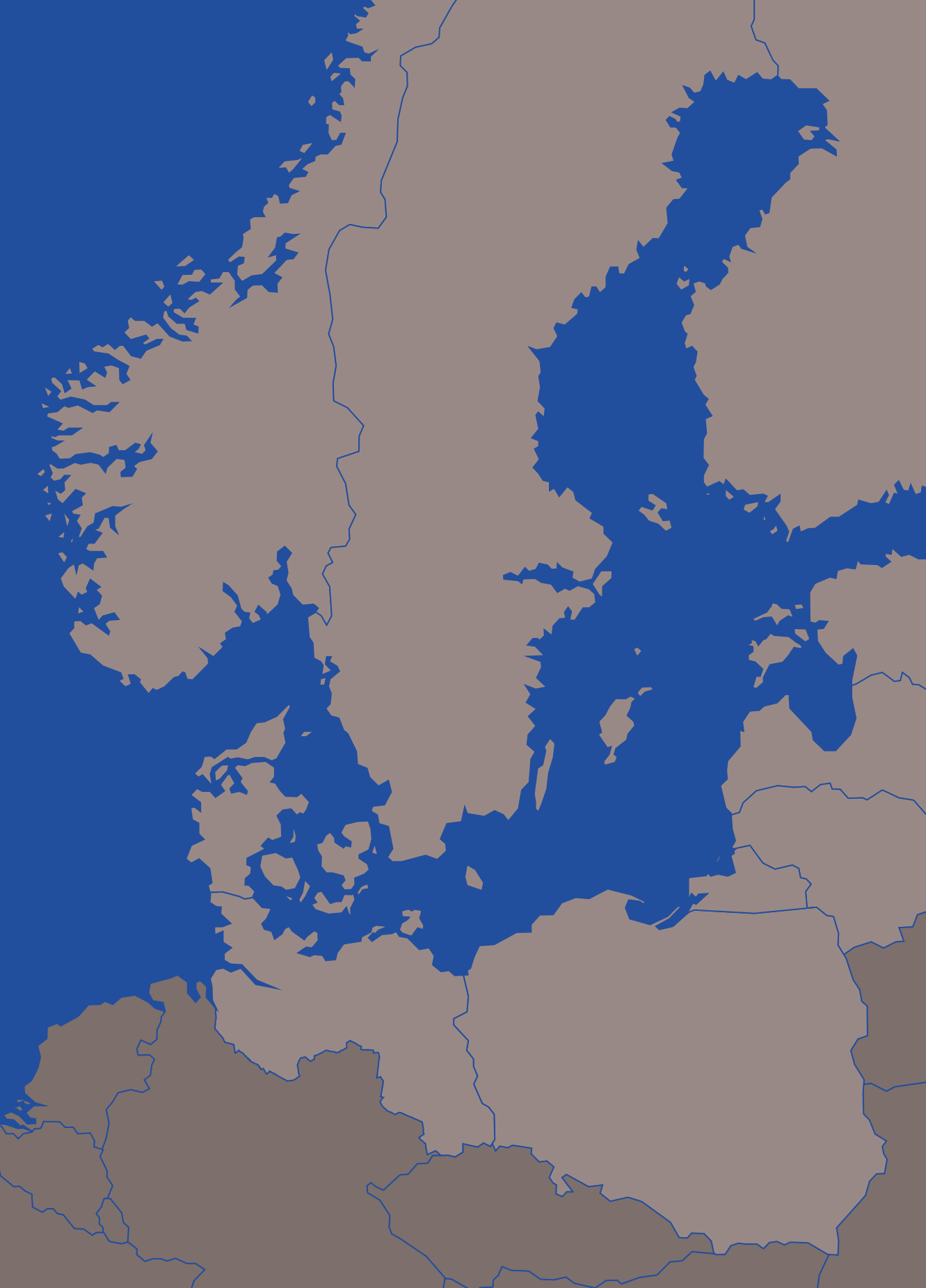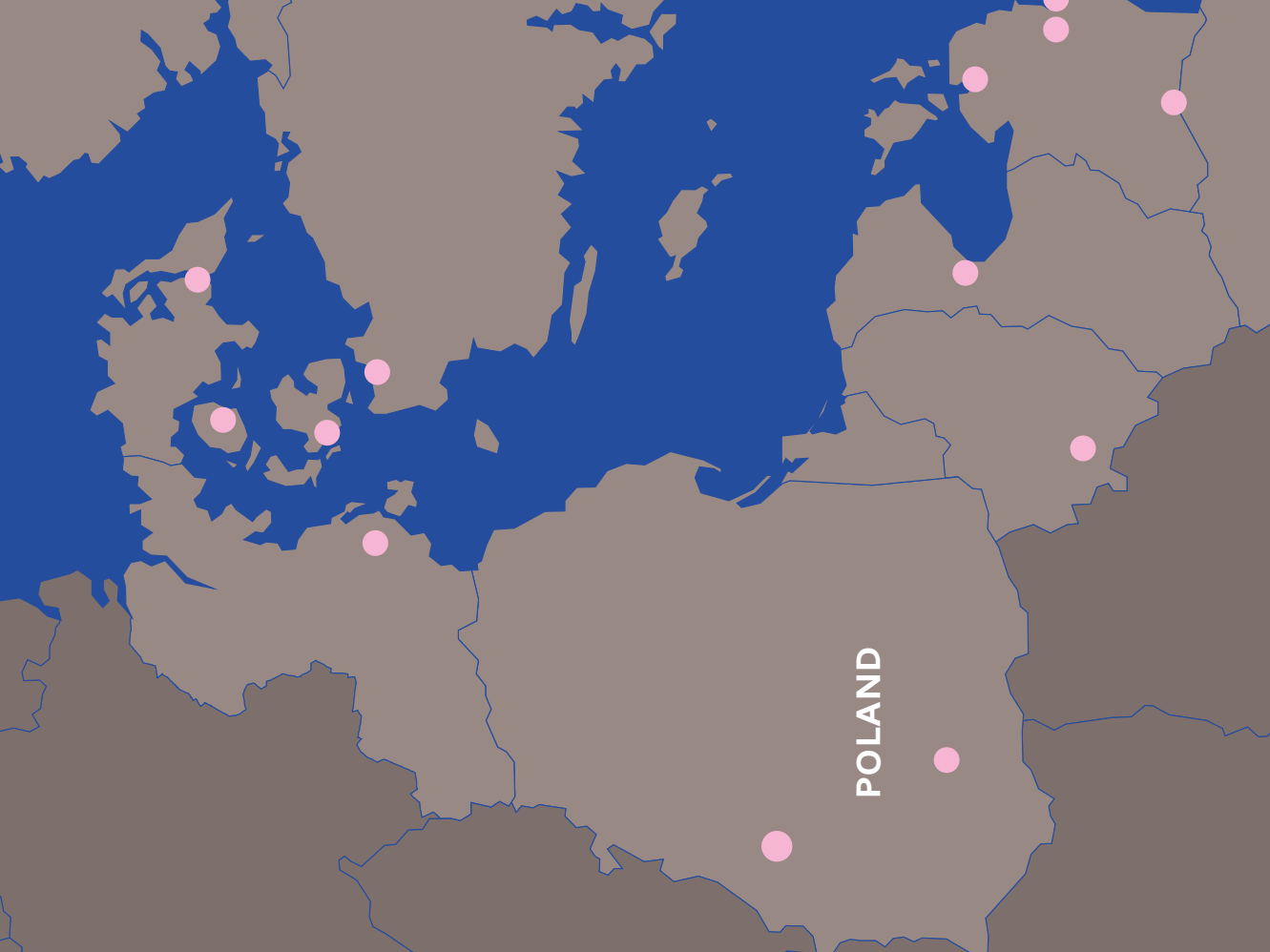
POLAND

LUBLIN MEDICINE CLUSTER

🌐 www.medicine.lublin.eu
www.medycyna.lublin.eu

📍 GEOGRAPHICAL OPERATING AREA: Lublin City and Province, Poland

👤 AUTHOR: Marzena Strok-Sadlo

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Lublin Medicine Cluster is an ecosystem managed by two well recognised and positioned public institutions: The Municipality of Lublin City and Medical University of Lublin. About 150 cluster members among others public hospitals and universities provide services, which support innovation development.
Cluster office staff has extensive experience working for international environment and projects.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

The City of Lublin is the ninth-largest city in Poland. It is the capital and the center of Lublin province with a population of about 340,000 inhabitants. The city is viewed as an attractive location for foreign investment. The analytical Financial Times Group has found Lublin to be one of the best cities for business in Poland. The Foreign Direct Investment ranking placed Lublin second among larger Polish cities in the cost-effectiveness category. Lublin is an academic city with about 62,000 students and 5 public universities and strong economic and medical services center. City is noted also for a high standard of living. To learn more about The Municipality of Lublin City visit the website:

www.lublin.eu

The Medical University of Lublin is teaching more than 6,800 students at four departments including English division with more than 1,300 foreign students. University owns one from the biggest and most modern Centre of Medical Simulation in Poland and 4 hospitals: Independent Public Teaching Hospital No. 1, Independent Public Teaching Hospital No. 4, Children's Hospital of Lublin and Dental Clinical Center.

The university maintains international scientific and clinical cooperation with universities and hospitals from around the world. To learn more about The Medical University of Lublin visit the website:

http://www.umlub.pl

LIVING LAB CORE TEAM MEMBERS

Marzena Strok-Sadło – Lublin Medicine Cluster Management Board Member, Head of Business Ecosystems Office at the Department of Strategy and Entrepreneurship in the City of Lublin.

- She has many years of experience in projects management and assessment gained from working with businesses for international financial institutions.
- E-mail: marzena.sadlo@lublin.eu

Iwona Pilarska – Lublin Medicine Cluster Office, Department of Strategy and Entrepreneurship in the City of Lublin.

- She gained experience necessary for working with businesses in Living Lab working for the Business Ecosystems Office with special focus on innovation development support.
- E-mail: iwona.pilarska@lublin.eu

LIVING LAB DESCRIPTION

Lublin Medicine Cluster as Lublin Living Lab is managed by The Municipality of Lublin City and Medical University of Lublin.

Health and medicine is among the main smart specialisations of the Lublin Province. As a result, about 150 members among public administration, universities and research centres, public hospitals, healthcare providers, technology companies, Institutiions for Collaboration (IFCs) and advisory companies has created the Lublin Medicine Cluster.

Lublin Living Lab activities are focused on functional food and dietary supplements development, diagnostics, telemedicine, telecare and robotics, oncology, cardiology, rehabilitation, health tourism, primary and secondary care, social and organisational innovation (including innovation for silver-aged).

Thanks to the broad cooperation network Cluster may offer also broad scope of services such as services of laboratories, products/services development, prototyping, product/services evaluation and testing with involvement of end users, short series production, contract manufacturing,consulting (marketing, financing, business models), incubation and acceleration programmes, preclinical and clinical trials.

This is typically done by drawing on public and private hospitals, medical centres, physicians, nursery homes, Third Age Universities and patient organisations who assist in innovation and end users involvement in the testing process.

Lublin Medicine Cluster is currently supporting innovation development within two internal projects:

Innotest — the purpose of the project is to create opportunity for SMEs including start-ups to validate, develop and test their innovative products and services in Cluster environment with involvement of experts, practitioners and end users.

InnoDesign – is developed to involve different groups of stakeholders including end users as a lead group in designing of innovative solutions based on defined end users' needs.

Lublin Medicine Cluster ecosystem is strongly supported by other clusters from Lublin Province including Lublin ICT Upland and Biotechnology Cluster and by the network of biggest Polish medical and Life Science clusters.

In result of dynamic Cluster development, broad scope of activities and effective promotion, Lublin Medicine Cluster is well recognised in the country and among partners from abroad.

(9)	(3)	(1)	(0)
9	3	1	0
(9) HIGH RELEVANCE	(3) MEDIUM RELEVANCE	(1) WEAK RELEVANCE	(0) NON-RELEVANT

LIVING LAB BUSINESS MODEL NOW

BM ELEMENTS	LIVING LAB BUSINESS MODEL ATTRIBUTES						
KEY PARTNERS	Research org.	Regional public org.	Municipals and cities	Networks and Clusters	State level org.	Digital service providers	NGOs, and third sector org.
	Education org.	Secondary care org.	Device manufacturers	Tertiary care org.	Primary care org.	Preventive health / wellbeing service providers	
KEY ACTIVITIES	Project mgmt.	Testing and co-creation	Funding support services	Marketing and sales	End-user services	Support services to state authorities	
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REVENUE STREAMS	Project grants	Fixed or permanent funding	R&D project and consulting service sales	Education and training services	Device and infrastructure rental	Donations	Royalties / Event and site visit fees / Equipment and device retail

LIVING LAB BUSINESS MODEL FOR 2021

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From raw material to products ready to market. Lublin Medicine Cluster supported new functional food development.

The objective of the test conducted at Lublin Medicine Cluster (Lublin Living Lab) was to deliver a formulation of functional food products based on green needle provitamin paste delivered by SilvEXPO company from Latvia. So far this pasta has not been used by company in functional food products.

END-USER TARGET GROUP:

- Extract from green conifer needles acts as a potent antioxidant, has anti-atherosclerotic action, as well as immunomodulatory properties.
- Adults potentially exposed to neurodegenerative and civilisation diseases are suggested as a target group of functional food products developed in Lublin Living Lab under ProVaHealth project.

POSSIBLE OTHER STAKEHOLDERS INVOLVED IN THE PROJECT:

- Services has been delivered in cooperation with experts from University of Life Sciences in Lublin.
- Products tested within the project went through sensory examination with involvement of real users.
- End users selected for the analyses were people showing correct reactions in the recognition of four basic flavours (sweet, salty, sour and bitter).

LIVING LAB ENVIRONMENT AND ACTIVITIES:

As a result of the collaboration three products (oil, candies and jellies) have been designed and produced in laboratory amounts. Products underwent sensory examination with involvement of real users. A report from the testing has been delivered to SilvEXPO. Lublin Living Lab has also delivered a report on registration procedures of functional food products in Poland as a support for a future commercialisation process on the Polish market.

BENEFITS OR OUTCOME OF THE PROJECT:

For SilvEXPO company cooperation with Lublin Medicine Cluster has allowed to carry out novel functional food product development, which was a new segment for the company, so they required knowledgable partner support to make the needed steps towards entering into this type of market. Prepared products adhered very well to company's requirements and specification. SilvEXPO benefited not only by tapping into new markets but also acquiring indispensible contacts for future collaboration.

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OUAS SimLab

🌐 www.oamk.fi/
www.ouluhealth.fi/

📍 GEOGRAPHICAL OPERATING AREA: Finland, Oulu

👤 AUTHOR: Tiina Tervaskanto-Mäentausta

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OUAS SimLab consists of versatile simulation environments for product development of health technology and welfare services. Companies and stakeholders can utilize SimLab services during the innovation process for testing and developing their products.

SimLab environments consist of simulation studios as well as lab environments of different professional health care areas (bio-analytics, nursing, public health, midwifery, emergency nursing, optometry, oral health care, radiography and radiation therapy, rehabilitation, social service).
We can offer versatile possibilities testing and developing products and services and training the staff.   OUAS SimLab operates as a part of the OuluHealth Labs and OuluHealth ecosystem.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Oulu University of Applied Sciences (Oulu UAS), one of the largest universities of applied sciences in Finland, established in 1996, is multidisciplinary higher education institution providing education and applied research and development. Oulu UAS serves the needs of the region's working and economic life and culture and maintains the diversity of higher education in Northern Finland. We have approximately 9,000 students and 580 staff members. Higher education is based on the requirements of internationalization, development of working life as well as research, artistic, and educational aspects. Our Bachelor's degree programs are on EQF level 6 and our master's degree programs on level 7. Oulu UAS's strategic focus areas are energy efficient construction for northern circumstances, Multifield business operations and entrepreneurial readiness, Services and technology promoting health and welfare, Renewing teaching of the university of applied sciences and teacher training. Our applied research, development and innovation work carried out at Oulu UAS and the development of business operations serve and support not only teaching, but also the development of the whole of Northern Finland, reforming its business and professional life. Oulu UAS educates competent and innovative professionals for the needs of working life. The operations of Oulu UAS promote the capabilities of the higher education community to take on international responsibilities. The goal is to develop and renew operations models in a diversified way together with working life and international partners. Networking nationally and internationally enables future know-how in innovative learning environments. Oulu UAS's quality system has been audited by the Finnish Education Evaluation Centre (FINEEC). We believe that good results will be achieved when the operations are planned, monitored, evaluated and developed systematically. Documentation plays a key role in quality assurance. Oulu UAS also promotes quality culture, develops self-assessment procedures and participates in external evaluations.

LIVING LAB CORE TEAM MEMBERS

Ms. Tiina Tervaskanto-Mäentausta, Principal Lecturer, PhD in Public Health Science, RN, specialized in Public Health, MNSc, Master of Arts in education and Educational Technology,

- tiina.tervaskanto-maentausta@oamk.fi
- As an educator I have developed and facilitated interprofessional teaching and training in under and postgraduate levels. Furthermore, I have been active developer of eLearning and simulation pedagogy. Planning and participating in R&D&I projects in national and international levels have been a part of my work over 15 years. My interest areas have been development of interprofessional team training in medical and health care. I have participated also developing the OuluHealth Labs concept. Connected to the OuluHealth ecosystem, OUAS SimLab has developed integrated testing facilities for SMEs and students to validate new technology and services to the health care and social welfare.

Ms. Minna Vanhanen, Senior Lecturer, RN, specialized in intensive care, MHSc, PhDc

- minna.vanhanen@oamk.fi
- My background is in intensive care where I worked several years as RN. Since 2008 I have been a lecturer at Oulu UAS. My special contents under and post graduate education in health care are interprofessional intensive care and counselling. Just now, I'm doing my doctoral thesis of quality of counseling. I have developed simulation pedagogy and it's integration in curricula over ten years in collaboration with University of Oulu, faculty of medicine. I'm the trainer of simulation pedagogy for professionals and educators regionally and internationally. Recently, I'm one of team member to develop testing and validation services for SMEs and students' participation in testing processes in OUAS SimLab.

Ms. Eija Hautala, Senior Lecturer, Master of Political Science

- eija.hautala@oamk.fi
- My response areas in education are basically social subjects. I'm the incubator counselor for students and the responsible lecturer in entrepreneurship in health and social sector. My tasks in ProVaHealth project have included especially entrepreneurship in health and social sector and it's specific issue as well as product development and networking.

LIVING LAB DESCRIPTION

OUAS SimLab consists of versatile simulation environments for product development of health technology and welfare services. Companies and stakeholders can utilize SimLab services during the innovation process for testing and developing their products.

SimLab environments consist of simulation studios as well as lab environments of different professional health care areas. We can offer versatile possibilities testing and developing products and services and training the staff.   It is possible to utilize both students' from different study programs (bioanalytics, nursing, public health, midwifery, emergency nursing, optometry, oral health care, radiography and radiation therapy, rehabilitation, social service) and teachers' feedback during the testing and development processes. OUAS SimLab provides safe environments for solution testing and validating before the certification. Any ethical requirements are needed. OuluHealth Labs provides an unique, integrated health test and development environment, including professionals' feedback for product development in every phase of the R&D process.

THE COMPANIES WILL CONTACT OULUHEALTH LABS TROUGH THE LINK IN WEBPAGE.

They fill in a template where they explain their needs. Together with the key persons the needs for the testing services will be checked regularly and shared the tasks and most suitable lab for testing.
Next, the testing plan (including the process, feedback and responsibilities) will be made with the company. We have developed the templates we use.

OUAS SimLab services 2020 are:

- Health-Sos forerunners – breafast meetings organized to companies, stakeholders, students and teachers
- sOULUtion – innovation workshops, where students from different programmes solve companies' problems using design sprint method
- Study course for students: Future products and services - Test and develop 5 ECTS. This course makes possible for students participation to innovation and testing processes.
- Products for companies produced with prices:

    1. User-centered development and testing services (several examples included)
    2. Renting the spaces and equipment's
    3. Presenting the simulation environment for groups
    4. Training & professional services for companies and stakeholders
    5. eChannel for companies to connect OuluHealth Labs, and for all stakeholders and real users connecting and sending the needs to be solved

LIVING LAB BUSINESS MODEL NOW

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LIVING LAB BUSINESS MODEL FOR 2021

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Intravenous therapy product

OUAS Simlab together with OuluHealth Labs partners has co-worked with Monidor company to help them conceptualize, validate and implement their intravenous therapy -product. This case was remarkable step integrating testing activities and academic studies utilizing the simulation environment and pedagogy.

END-USER TARGET GROUP:

The product was mainly focused to nurses working in hospitals or home healthcare. The product helps nurses set the infusion speed accurately, control the IV therapy better and reduce the risks of mistakes. The product improves patient safety as well.

POSSIBLE OTHER STAKEHOLDERS INVOLVED IN THE PROJECT:

In conceptualizing phase, the nurse and paramedic teachers were interviewed. Next, in the prototype phase nurse and medical students tested the product while they were training in simulation. The testers were introduced before testing to the tool and interviewed after the testing. In validation phase several groups of students took part to the testing process. Finally, they tested the instructions of the use the tool.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

Using the simulation environment was an excellent possibility to integrate testing in real-like patient care situation. This was practical before the certification of the product. Any ethical requirements were needed.

BENEFITS OR OUTCOME OF THE PROJECT:

The product was developed and produced in collaboration with all the three OuluHealth Labs environ-ments. In marketing phase, the company utilized again the simulation environment producing the marketing material. The collaboration with OUAS SimLab are continuing with research projects of the students to get reference material for the product
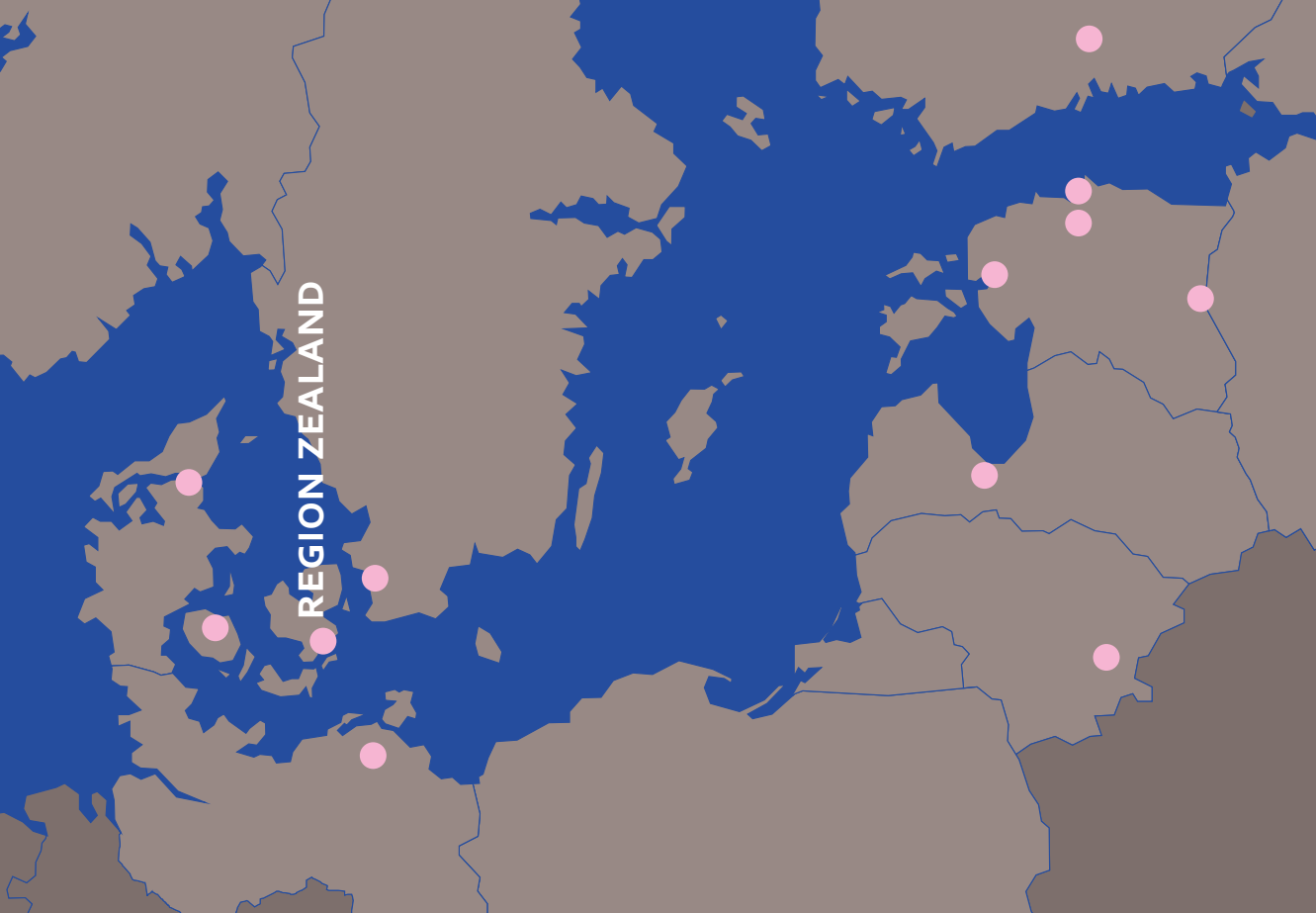
REGION
SJÆLLAND

Living Lab: One Point of Entry (OPE)

https://www.regionsjaelland.dk/Kampagner/Medicinsk-udstyr/Sider/default.

https://www.regionsjaelland.dk/Kampagner/Medicinsk-udstyr/Sider/Om-medicinsk-udstyr.aspx

GEOGRAPHICAL OPERATING AREA: Region Zealand is one out of five regions in Denmark.

AUTHOR: Erik Branderin

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Region Zealand provides LL services to private partners through different facilities. This is mainly done through the unit One Point of Entry. This is the entrance for private companies to the region with regard to developing and/or testing medtech product and services related to healthcare. The unit facilitates contact to relevant departments in the region, primarily at hospitals.

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Region Zealand is one of the five administrative regions in Denmark. It provides healthcare services for about 820,000 citizens. The main task of the region is to run and develop its six regional hospitals as well as mental health services and social institutions. The region has more than 17,000 employees. The region has a major role in a network of cooperating partners, who work for a dynamic and coordinated development throughout the region, among others for business, education, urban development, public infrastructure, and certain environmental areas.

The unit One Point of Entry is operated by the department Data and Development Support (DDS). Its core tasks are to support Region Zealand's departments and units in setting strategic direction as well as assisting them in the areas of innovation, research, data analysis and improvement of operations. DDS' efforts in the field of innovation contribute to the region's quality, efficiency and development goals. This is done in collaboration with private companies, knowledge institutions and citizens. The department also initiates and strengthens local research environments at the region's hospitals. DDS houses the region's data warehouse. On this basis, it carries out data analysis and reporting. It further provides management information and inputs to innovation, research as well as quality and improvement work.

LIVING LAB CORE TEAM MEMBERS

Lotte Sivertsen
- Senior consultant
- lsie@regionsjaelland.dk
- Regional and business development, innovation, research and strategy formulation.

Erik Brander
- Chief consultant
- eribr@regionsjaelland.dk
- Work process improvement, innovation, business development and financial and economic analyses.

Jesper Nørgaard Reumert
- Chief consultant
- jrm@regionsjaelland.dk
- Innovation, regional and business development, strategy formulation and ecosystem development.

LIVING LAB DESCRIPTION

The unit One Point of Entry is the entrance for private business companies to the region concerning development and/or testing of medtech product and services related to healthcare. The unit facilitates contact to relevant departments in the region, primarily at hospitals, but also to other healthcare related centres and departments. This is where actual innovative product development and testing takes place in cooperation projects between the business partner and the regional healthcare units. Cooperation projects focus on products and services that meet the needs of Region Zealand as a healthcare procuder

One Point of Entry for medical devices offers the following services:

- Process-related services
- Initial screening of product or service to determine the potential value of cooperation to the customers and to the region itself,
- Establishing a match between the business company and one or more departments within the region's hospitals and centres,
- Custom-made assistance to establish and facilitate collaborative innovation projects between the customer (the business company) and the region,
- Sparring on ideas for products and services before innovation process starts,
- Co-creation of products and services. Examples: apps, eHealth and mHealth related products and services, certain work processes, software – e.g. for planning of manning of service delivery processes, etc.),
- Planning and carrying out of tests of products and services,
- Validation of test results according to international protocols for innovation and research.

Other services and end-user groups:

- General advice and assistance in implementing innovative projects between private and public partners,
- Identification of and making relevant users/end-users available for development and test of products and services: healthcare staff, patients, citizens – and administrative staff,
- Active use of the region's healthcare data to support development of products and services,
- Advice on public procurement related to products and services,
- Information on market aspects.

The goal of OPE is for companies to become stronger in the market after participating in a process of developing a new product or service and/or testing a new solution.

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COST STRUCTURE	Personnel	Infrastructure and facilities cost	Internal R&D development	Travelling costs	Consulting fees for external experts	IPR-protection	End-User fees and other variable costs	Outsourced services	Marketing and sales
REVENUE STREAMS	Project grants	Fixed or permanent funding	R&D project and consulting service sales	Education and training services	Device and infrastructure rental	Donations	Royalties	Event and site visit fees	Equipment and device retail

REGION
SJÆLLAND

Optimisation of Electronic Health Record (EHR) systems through UX (User eXperience) technology

A project between the company Adusso and Region Zealand to pilot level test Adusso's UX product when using EHR systems. Was tested on a small EHR system used by the regional service Active Patient Support. Objective of company: to establish ease-of-use and usefulness of the product to identify possible areas for product improvements. Objective of Region Zealand: to identify potentials for improving the EHR system's performance and possibly use the test results on other regional EHR systems.

END-USER TARGET GROUP:

The main end-users: test persons who were five staff members of the regional service Active Patient Support. IT staff assessed the ease of installing the software tested. Other potential end-users: EHR system developers to become involved in using the test result to improve the EHR system.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

The test was carried out in Region Zealand offices at two different locations in the region. Activities included:

- Preparatory work: Determining the test infrastructure required by the company Adusso whose product was tested. Followed by design of the test process.
- Formulation of Non Disclosure Agreement and Data Processor Agreement to comply with the GDPR.
- Kick-off meeting to brief staff of Active Patient Support (APS) about the nature of the test, viz. what the test programme performs, what the test persons can or has the opportunity to do, and to clarify questions.
- Installation of the application (computer software) on workstations at the premises used by APS staff.
- Actual testing of the EaHR system used by APS staff using the programme Adusso_UX_monitoring. Carried out in six days over two consecutive weeks.
- Wrap-up workshop to present and discuss test results and how Adusso, the test organisation APS, and Region Zealand, can use them in general.

BENEFITS OR OUTCOME OF THE PROJECT:

Main benefits expressed by the customer:

- Legal issues take time to deal with but can be handled according to the GDPR and Danish regulations.
- A Data Processing Agreement can be made efficiently by using a standard template for the purpose.
- Appropriate to preset settings of the software before installation to avoid problems.
- Software tested slowed down some workstations to various degrees.
- A model developed for storage of data locally and subsequent transmission to Finland for processing.
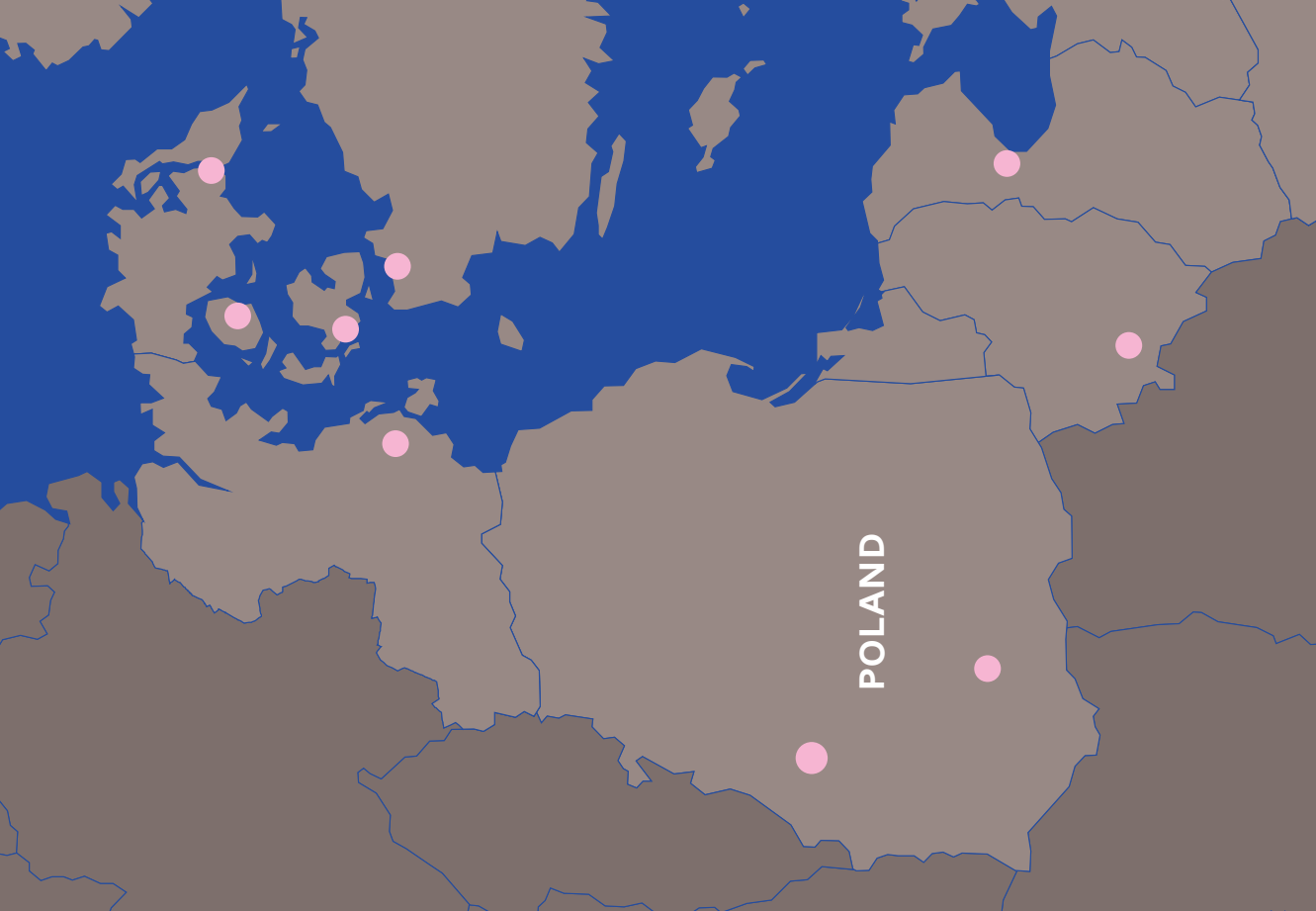
POLAND

GAPR

Professor Zbigniew Religa Foundation of Cardiac Surgery Development

🌐 https://frk.pl/index.php?IdLang=1; https://frk.pl/ aspx

📍 GEOGRAPHICAL OPERATING AREA: Poland, Silesia Region, Zabrze, Gliwice, Katowice, others

👤 AUTHOR: Beata Krawczyk

> **" For 15 years, the Agency has intensively been working for the benefit of science, business and local government, and also manages MedSilesia Cluster that associates over hundred members that operates in the health care area.**

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Upper Silesian Agency for Entrepreneurship and Development (GAPR) in Gliwice is a company with the City of Gliwice as the main shareholder, whose task is especially to support micro, small and medium-sized enterprises. For 15 years, the Agency has intensively been working for the benefit of science, business and local government, and also manages MedSilesia Cluster that associates over hundred members that operates in the health care area. One of the most active Cluster member is the Professor Zbigniew Religa Foundation of Cardiac Surgery Development which acts as a Living lab and offers numerous services of testing.

The goal of the Foundation for the Development of Cardiac Surgery in Zabrze, founded in 1991 by prof. Zbigniew Religa, is the introduction to clinical practice of modern techniques and technologies in the treatment of an endangered heart. The Foundation conducts scientific research and implementation works related to the Polish artificial heart, biological heart valve prostheses, a surgical robot and innovative surgery tools as well as tissue engineering used for therapeutic purposes. Co-finances scientific and didactic publications. Organizes specialized workshops, conferences and symposia. It promotes an active, healthy lifestyle as the best prevention of heart disease. It is a modern scientific and research center for the Polish cardiac surgery and a center for the exchange of thoughts and experiences.

LIVING LAB CORE TEAM MEMBERS

Dr. hab. n.med. Piotr Wilczek, Professor of IPS, p.wilczek@frk.pl
- **Head of the bioengineering laboratory within Institute of Heart Prostheses of the Foundation. His research focuses on issues related to tissue engineering, cell therapies and regenerative medicine, especially in the area of tissue scaffolds (suits) and bioprosthesis of heart valves.**

Msc. Beata Krawczyk, bkrawczyk@gapr.pl
- **Specialist in the Upper Silesian Agency for Entrepreneurship and Development, coordinates communication between companies and Living lab, sets testing dates and conditions, prepares documentation, support main testing activities**

LIVING LAB DESCRIPTION

MedSilesia is a cluster of innovative companies within medical products in the Silesia region, managed by the Upper Silesian Agency for Entrepreneurship and Development Ltd (GAPR). MedSilesia concentrates on innovative technologies within rehabilitation, surgery and orthopaedic tools, diagnostic equipment, cardiology and other medical areas. Our mission is an efficient platform for collaboration between enterprises, research and development units; enhancing the combined potentials to implement innovative solutions, technology and knowledge transfer, exchange of experiences and implementation of joint projects. Keywords: Medical industry, internationalization, joint projects.

Professor Zbigniew Religa Foundation of Cardiac Surgery Development in Zabrze (Silesia Region, Poland), one of the most active member of the cluster, offers a number of various tests activities as a Living lab. The foundation uses scientific activities - research in the field of heart prostheses and heart valves as well as biocybernetics, bioengineering and biotechnology. Main research directions for work with heart prostheses and heart valves and research in the field of biotechnology and bioengineering. The functional foundation also has a tissue bank in which heart valves, corneas, tendons and skin dressings are developed. The Foundation also implements a training and scholarship program for medical staff from Poland and abroad. Selected from many others, main specialized activities are the following:

- Medical devices designing and development
- Electronic signal processing and measurement techniques applying
- Design and development of specialized, based on customer requirements equipment for tissue and organs culture in close to physiological conditions
- Modeling methods adapting for various expert systems adapting
- Supervising, coordinating and conducting pre-clinical and clinical trials of medical devices and products in accordance with the relevant standards and legal requirements
- Design, manufacture of prototypes, in vitro & in vivo testing of surgical robots and mechatronic surgical instruments

9	3	1	0
(9) HIGH RELEVANCE	**(3) MEDIUM RELEVANCE**	**(1) WEAK RELEVANCE**	**(0) NON-RELEVANT**

LIVING LAB BUSINESS MODEL NOW

BM ELEMENTS	LIVING LAB BUSINESS MODEL ATTRIBUTES								
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LIVING LAB BUSINESS MODEL FOR 2021

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REVENUE STREAMS	Project grants	Fixed or permanent funding	R&D project and consulting service sales	Education and training services		Device and infrastructure rental	Donations	Royalties	Event and site visit fees	Equipment and device retail

Testing the CompactaSteril® device in conditions of the treatment room, during the simulated surgery

Surgical site infection (SSI) is a common problem regarding hospital infections and in treatment rooms. This creates a significant burden for patients, increasing the risk of postoperative complications. Thus, creating an additional budgetary burden for health care units. One of the more important factors causing SSIs is the airborne particles that carry bacteria. In pilot studies it has been assessed the effectiveness of the ComapactaSteril® ultra clean air system.

END-USER TARGET GROUP:

The device is ultimately intended for use by medical personnel: doctors, nurses, veterinarians, medical and veterinary assistants in clinics and hospitals in treatment rooms as well as in veterinary clinics.

**POSSIBLE OTHER STAKEHOLDERS INVOLVED IN THE PROJECT:**

A biotechnologist participated in the testing process, whose task was to take samples and analyze the collected material in terms of measuring the CFU (Colony Forming Unit) parameter.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

According to the assumption, the examined device should significantly reduce the risk of contamination of the treatment and operational field. The correctness of this assumption was tested on a small animal's model under simulated conditions in the treatment room. For the study the rabbits, New Zeeland race were used. The study group was homogeneous in terms of age, weight and sex. Before starting the test, the rabbits were properly prepared: the hair has been shaved in place of a potential operating field, completely devoid of fur, then the skin was washed and disinfected. Before the surgery, the animal was covered with sterile undercoats, and a special foil was applied to the skin. The experiment consisted of simulating surgical procedure with minimally invasive access from thoracotomy. The adopted research model proved to be adequate, and the conducted tests indicate that the use of the CompactaSteril® device can significantly reduce the risk of contamination of the treatment area.

BENEFITS OR OUTCOME OF THE PROJECT:

The testing process proved the impact of the device's operation on reducing the risk of treatment area contamination and thus accelerated and facilitated the company's further activities on the way to launch the device on the market. Furthermore, performing testing for Compacta AB has contributed to development of the Professor Zbigniew Religa Foundation of Cardiac Surgery Development's living lab, responsible for the whole process.

CoLab Plug and Play

🌐   https://frk.pl/index.php?IdLang=1; https://frk.pl/ aspx
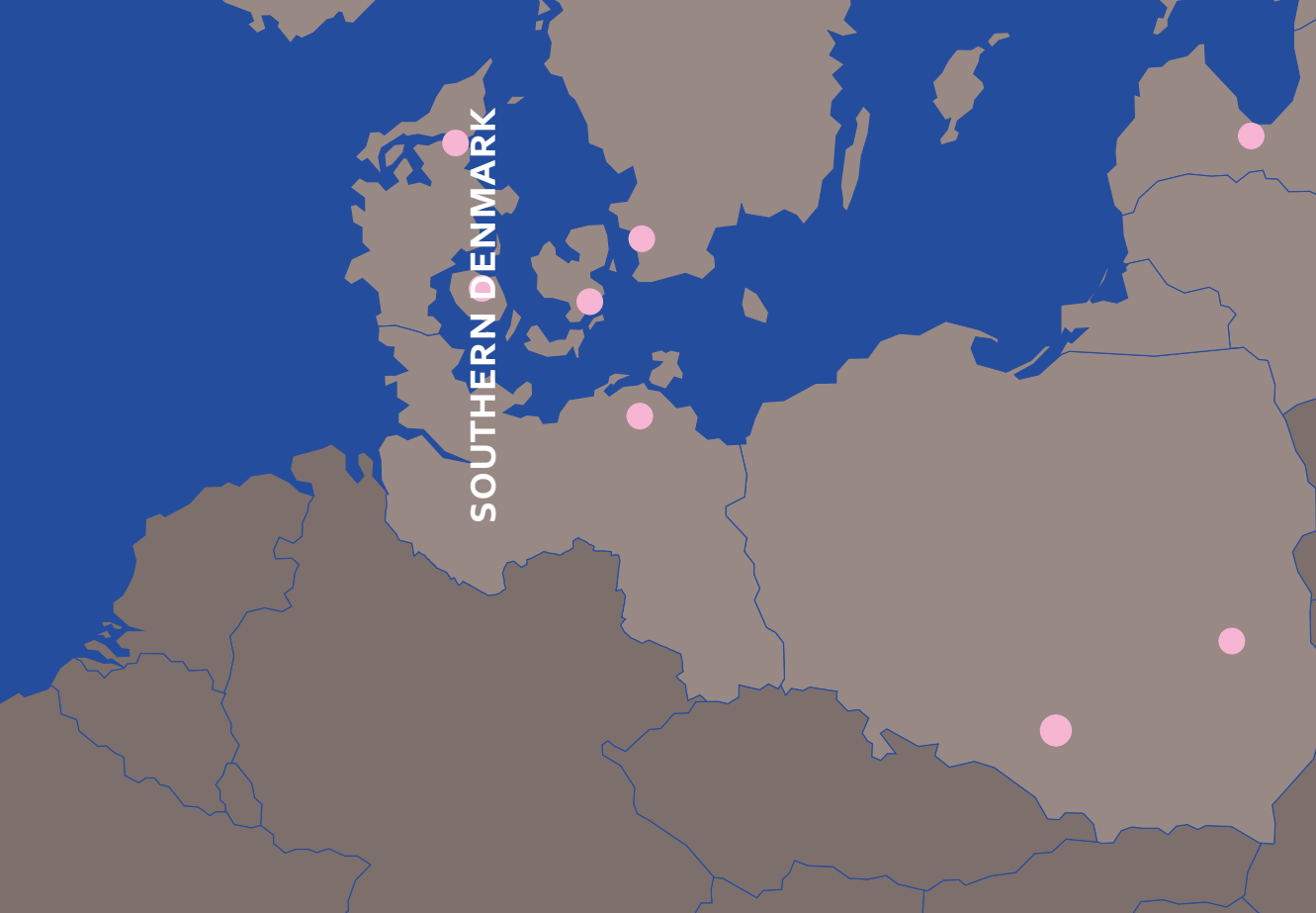
📍   GEOGRAPHICAL OPERATING AREA: The Region of Southern Denmark

🧑‍🏫   AUTHORS: Jens Dinesen Strandbech & Emil Kjärsgaard Nielsen

> *Our main purpose is to support the Regional Council and the Group Management in converting the regional innovation strategy into actions and value creation. We do this by supporting the hospitals, social and psychiatric facilities as well as the pre-hospital centred area in developing their services to tackle the current and future challenges that the Danish healthcare sector are faced with.*
>
> *We do that by offering private companies and public organisations a range of services such; Idea generation, conceptualization, prototyping and/or physical tests in closed environment or real-life settings.*

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

CoLab Plug and Play is part of Health Innovation Centre of Southern Denmark (HIC). HIC is the first regional staff unit for health and welfare innovation in Denmark. HIC functions as an innovation consultancy for all departments in the Region of Southern Denmark (administration, hospitals, psychiatric and social service, etc.) and for other partners, such as municipalities and private companies. HIC supports the innovation process from idea generation to implementation within the business areas of healthcare technology, telemedicine, optimized operation and future-proof construction.

We see ourselves as:

• A hub for knowledge and know-how, as we collect and distribute knowledge, we empower others in their work and we guide collaborations in innovation.

• Consultants, as we facilitate user involvement and carry out tests and development of products and services. We identify and analyse needs and opportunities, we analyse the potential benefits, we facilitate public-private innovation and we assist in gaining funding.

• Project facilitators, as we fulfill the role as Programme- or Project Managers, or particpate in projects as a partner or supporting partner.

• https://www.innosouth.dk/service-menu/about-us/

LIVING LAB CORE TEAM MEMBERS

CoLab Plug and Play is part of Health Innovation Centre of Southern Denmark (HIC). HIC employs 67 persons were of many a specialists in their field. As examples of the diverse fields, which are covered can be mentioned architects, designers, engineers, anthropologists, IT-engineers, nurses, physiotherapists etc. As an internal staff function in the region, we can furthermore draw upon the clinicians and other specialist in the rest of the region, which in total approximates to 26,000 employees.

Morten Givskud

- Innovation consultant and coordinator for Colab Plug & play
- Morten.Givskud@rsyd.dk
- +45 2465 0141

LIVING LAB DESCRIPTION

In Colab Plug and Play and HIC we have innovation as our central focus, and our work always starts with the needs of the users. We employ co-creation to develop strong solutions that add value for the citizens and for the healthcare sector.

We do that by offering private companies and public organisations a range of services such; Idea generation, conceptualization, prototyping and/or physical tests in closed environment or real-life settings, we apply following services and products:

- Facilitation, project management, and consultancy of development projects between public and private partners.
- Test runs, user surveys and identification of needs in relation to usability, service design, technical requirements, and product- and organisational development.
- Workshop facilitation, co-creation setups between end-users and manufacturers, and the possibility to test work procedures in a 1:1 ratio mockup construction.
- Impact Assessment and documentation of new solutions, such as business cases in relation to public operation and certification based on testing in public operation environments.
- Facilitation of digitised collaboration agreements between sectors that will help to improve the continuity of care, and facilitation of aggregated data sharing that will improve the possibility for cross-sectoral data analyses.
- Development and implementation of infrastructure and standards for data sharing and user involvement.
- Coordination and implementation of MedCom standards, and consultancy on digital platforms in the healthcare system.
- Preparation of applications to public and private funds.

9	3	1	0
(9) HIGH RELEVANCE	**(3) MEDIUM RELEVANCE**	**(1) WEAK RELEVANCE**	**(0) NON-RELEVANT**

LIVING LAB BUSINESS MODEL NOW

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VALUE PROPOSITIONS	R&D Services	With real end-user	Customized services	Ecosystem and project mgmt.	Funding support	Method development	Funding	
	Unique infrastructure	Various positive arguments	Multi-disciplinary	Value and impact evaluation	Education and training	Marketing Support		
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REVENUE STREAMS	Project grants	Fixed or permanent funding	R&D project and consulting service sales	Education and training services	Device and infrastructure rental	Donations	Royalties	Event and site visit fees	Equipment and device retail

UUSIMAA REGION

LAUREA

AMMATTIKORKEAKOULU
University of Applied Sciences

Laurea Living Lab

🌐 www.laurea.fi

📍 GEOGRAPHICAL OPERATING AREA: Finland's capital area and Uusimaa region.
This area covers the cities of Helsinki, Vantaa, Espoo, Hyvinkää, Lohja and Porvoo.

👤 AUTHORS: Mikko Julin & Teemu santonen

"

Laurea Universtity of Applied Sciences is a forerunner of living lab activities in Finland. We have operated these in healthcare products and services, homecare, SME innovation development and restaurant services. For example degree students of our bachelor of hospitality management program run Bar Laurea "Flow" restaurant in our Leppävaara campus in Espoo. The state-of-art living lab services for domestic and international SMEs in health

LIVING LAB HOSTING ORGANIZATION DESCRIPTION

Laurea University of Applied Sciences operates in Uusimaa region at six different campuses. There are about 7,400 students, 550 staff members and more than 26,000 alumni in our community. The strategic intent of Laurea University of Applied Sciences is to be an international developer of working life competence and vitality in the region in 2030. One of the strategic goals of our university is to expand and deepen the co-operation with our regional, national and international partner networks.

At Laurea we want to connect partner organizations and/or RDI-projects in the studies of our pupils. This is called Learning by Developing (LbD) pedagogic action model. It is our strategic choice, that enable efficient collaboration with partner universities, SMEs and networks.

We want to be an international operator as an university, supporting our regional development. This is one of our strategic themes supporting the choices made.

LIVING LAB CORE TEAM MEMBERS

- **Mikko Julin, senior lecturer, MSc.**
- **Teemu Santonen, principal lecturer, Ph.D. Econ.**
- **Tuija Hirvikoski, director, Ph.D.**

LIVING LAB DESCRIPTION

Service Design (SD) Approach and Co-creation methods – Developing and testing with real users, in real environments

Co-creation using tools of service design (SD) is in the core of Laurea offering. Service design has become a central framework used within many organizations to innovate services. It is about planning, developing and innovating services through specific iterative service development processes. SD brings new methods, techniques and tools to improve, innovate, and visualise the service offering, processes, and organization. The purpose of SD is to create a customer-centric service experience that meets the needs and demands of the customers and fulfils the service provider's business objectives. Through a SD approach, diverse teams can collaboratively identify needs, ideas, experiences and opportunities and generate fast prototypes to be tested by the real users and customers. SD helps to innovate (create new) or improve (existing) services to make them more useful, usable, desirable for customers and efficient as well as effective for the organization. In the project, co-creation and service design refers to collaborative design activities with users and all other stakeholders across the whole span of the project.Generic description of your living lab. The aim is to give an open-ended high-level overview of your living lab, its activities and what kind of environments, services and end-user groups you can provide for potential customers. Basically, this text gives an open-ended description relating your business model and service profile, which are visualized below. Verify that you text is in line with your business model and service profile. Remember this is marketing text.

9	3	1	0
(9) HIGH RELEVANCE	(3) MEDIUM RELEVANCE	(1) WEAK RELEVANCE	(0) NON-RELEVANT

LIVING LAB BUSINESS MODEL NOW

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LIVING LAB BUSINESS MODEL FOR 2021

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LAU REA

CoHeWe: multi-sensory space supporting care of older adults with memory disorders

The objective was to support the care of older adults who have memory disorders by building a multi-sensory space in a senior centre. The aim was to develop a multi-sensory space that would assist with tackling e.g. anxiety and decline of physical health that are often associated with memory disorders. The space would also help provide stimuli and exercise opportunities in a resource-effective way with regards to senior centre personnel.

END-USER TARGET GROUP:

End-users were older adults with memory disorders living in a senior centre.

**POSSIBLE OTHER STAKEHOLDERS INVOLVED IN THE PROJECT:**

Other stakeholders were senior centre personnel, other public sector organisation personnel, companies offering their solutions, and CoHeWe project staff from the city.

LIVING LAB ENVIRONMENT AND ACTIVITIES:

The need for the solution was discovered and defined by healthcare professionals and managers. A Request for Information (RFI) was published to reach potential service provider companies. A group of the companies who responded to the RFI were invited to a market dialogue where a jury evaluated the potential of the suggested solutions. Several digital and other solutions were then selected to be tested in the multi-sensory space in the senior centre.

BENEFITS OR OUTCOME OF THE PROJECT:

The case is still ongoing, however based on the feedback from the senior centre there are some benefits already to be seen. These are mainly to do with successfully tackling anxiety of older adults with memory disorders by use of the multi-sensory space. Also the senior centre personnel has reported that the space is relaxing and brings them joy. This seems to add wellbeing to the work days, which is a significant finding considering the demanding nature and limited resources of the work.
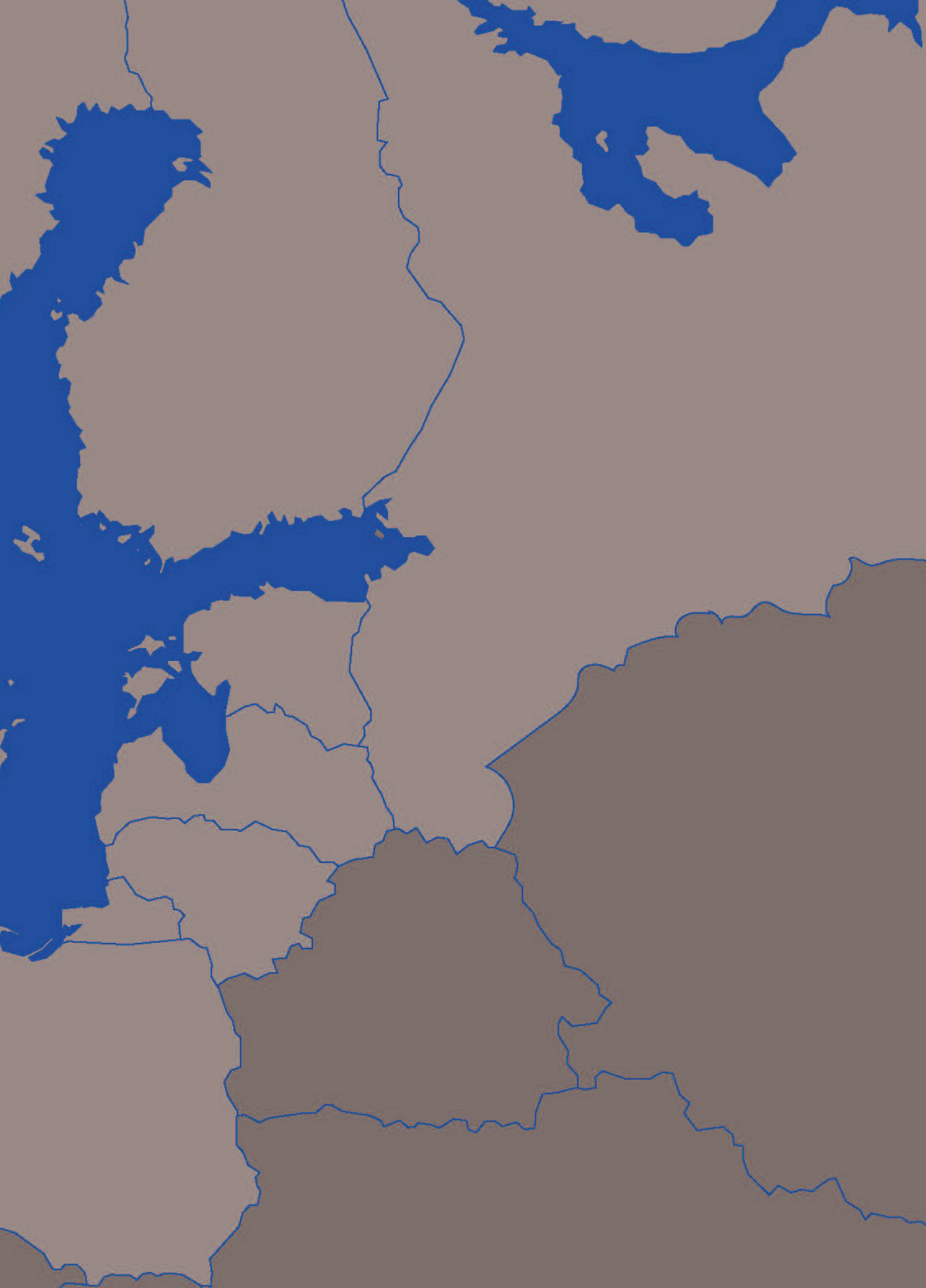
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APPENDIX 1: LIVING LAB BUSINESS MODEL ATTRIBUTES

	KEY PARTNERS	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	**RESEARCH ORGANIZATION:** (e.g. research institutions, universities, national research centers and institutes, research councils, research experts).	5,53	6,87	2	1,33	*
2	**EDUCATION ORGANIZATION:** (e.g. educational institutions, universities, students, teachers)	5,47	6,73	3	1,27	*
3	**REGIONAL PUBLIC ORGANIZATION:** (e.g. Regional support and administrative departments, regional council, regional government)	5,20	6,13	5	0,93	
4	**SECONDARY CARE ORGANIZATION/UNITS:** (e.g. health services provided by medical specialists and other health professionals for inpatients on referral from a primary health professionals)	4,93	5,73	7	0,80	
5	**MUNICIPALS AND CITIES:** (e.g. administrative and development departments)	4,80	6,00	6	1,20	
6	**TANGIBLE EQUIPMENT AND DEVICE MANUFACTURERS AND INDUSTRY PARTNERS:** (e.g. companies/Industry partners, International mHealth/IT industry, long term company relationship, SMEs, medical devices and equipment providers, industry experts (groups)	4,73	7,00	1	2,27	**
7	**NETWORKS AND CLUSTERS:** (e.g. Company cluster organizations, Company networks, international partners and networks, cluster members, ecosystem partenrs, Life science cluster, accelerator, life science innovation, affiliated LLs)	4,67	6,67	4	2,00	*
8	**TERTIARY CARE ORGANIZATION/UNTIS:** (e.g. specialized higher level consultative health care within the hospital, usually for inpatients and on referral from a primary or secondary health professional)	4,13	4,80	10	0,67	
9	**STATE LEVEL ORGANIZATION:** (e.g. State budgetary unit, Health data authority, Ministry of education)	4,13	4,33	12	0,20	
10	**PRIMARY CARE ORGANIZATION/UNITS:** (e.g. health professional organizations who act as a first point of consultation for all patients within the healthcare system).	4,00	5,07	8	1,07	
11	**E-HEALTH, M-HEALTH AND DIGITAL SERVICE PROVIDERS AND DEVELOPMENT COMPANIES**	4,00	5,60	9	1,60	*
12	**PREVENTIVE HEALTHCARE, WELLBEING AND WELLNESS SERVICE PROVIDERS:** (e.g. fitness centres, gyms, coaching, personal training, spa, beauty services, physiotherapy)	3,07	4,40	11	1,33	*
13	**NGOs, NPOs and THIRD SECTOR ORGANZIATION:** (e.g. 'value-driven' organizations promoting, supporting or serving specific objective(s) or causes including such as patients associations, senior associations)	2,20	4,27	13	2,07	**

	KEY ACTIVITIES	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	**PROJECT MANAGEMENT AND COORDINATION** (e.g. managing multi stakeholder project)	5,13	6,20	4	1,07	*
2	**EDUCATION AND TRAINING SERVICES** (e.g. basic, in-service training, simulated learning environments, expert lectures, Educational training for SMEs, Consulting other stakeholders to use LL methods)	4,87	6,60	2	1,73	*
3	**PRODUCT OR SERVICE RELATED R&D SERVICES INCLUDING TESTING AND DEVELOPMENT** (e.g. product or service related testing and development projects, , User-center workshops, Project management, Clinical trials, Provide consultations, Guidance to develop medtech solutions, Need and market analysis, Customer journey)	4,73	7,80	1	3,07	**
4	**(INNOVATION) ECOSYSTEM NETWORK MANAGEMENT, FASILITATION AND/OR ORCHESTRATION** (e.g. Management of stakeholder and customer networks, offering Single point entry services, Connecting partners, developing relations, Networking and networking meetings, Open access to infrastructure)	4,27	6,33	3	2,07	*
5	**GRANT WRITING AND FUNDING APPLICATION SUPPORT SERVICES** (excluding acting as funder or investor)	3,80	5,73	5	1,93	*
6	**SUPPORT SERVICES TO REGIONAL** AUTHORITIES (e.g. Regional innovation governance and support system, Regional virtual app centre, Public-Private-Partnership agreement activities at regional level including support to political committees)	3,13	3,93	7	0,80	
7	**MARKETING AND SALES** (e.g. Marketing and sales support, customer acquisition, Raising awareness and knowledge in healthcare data, writing articles, Organizing events, Technology library)	2,80	4,87	6	2,07	**
8	**SUPPORT SERVICES TO LOCAL MUNICIPAL AND CITY AUTHORITIES** (e.g. activities going beyond singe R&D projects, Public-Private-Partnership agreement activities at municipal or city level including support to political committees)	2,53	3,73	8	1,20	*
9	**FINAL END-USER SERVICES** (e.g. services for final product or service end-users, personal wellbeing data)	1,80	2,13	11	0,33	
10	**PROVIDING FUNDING TO APPLICANTS** (e.g. running investment program or fund, acting as an investor)	1,47	2,27	10	0,80	
11	**SUPPORT SERVICES TO STATE LEVEL** AUTHORITIES (e.g. innovation governance and support system at national level, Public-Private-Partnership at national level including support to political committees)	1,27	3,00	9	1,73	*

	KEY RESOURCES	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	**PERMANENT PERSONNEL** (e.g. personnel, staff, human resources, researchers, teachers and trainers, cross disciplinary teams, Arena management team, Project management, students who receive salary, know-how which personnel)	5,73	6,87	1	1,13	
2	**INFRASTRUCTURE AND TECHNOLOGIES** (e.g. facilities, infrastructure, premises, wellcome center tools, regional campuses, Simlab, Virtual App Centre, Single Point Entry, technology library, network of local LLs, access to health care data infrastructure, IT infrastructure, other similar technologies)	4,40	6,47	2	2,07	*
3	**PARTNER(S) AS DEFINED KEY PARTNER SECTION** (e.g. tangible and digital manufacturers and industry partners as well as municipals, cities, regional or state level authorities, Intellectual Property Rights (IPR) consults)	3,80	5,40	5	1,60	*
4	**EXTERNAL NETWORKS** (e.g. memberships in (well stablished) international network, university and industry networks)	3,60	5,40	6	1,80	*
5	**END-USER AND PATIENTS PANEL** (e.g. permanent access to patients and customers wide range with different diagnosis)	3,33	5,47	4	2,13	**
6	**STUDENTS RECEIVING STUDY CREDITS** (e.g.-bachelor, master or Ph.D level students who gain study credits instead of salary, participation is based on educational purpose instead earning a living)	3,20	4,93	7	1,73	*
7	**DATA DATABASES AND SCIENTIFIC PUBLICATION DATABASES** (e.g. open databanks, cumulative databank from end-users and/or clients, internally collected data, access to scientific publication databases)	3,13	5,67	3	2,53	*
8	**INDIVIUDAL PERSONS ACTING AS EXTERNAL EXPERTS, NOT PART OF THE PERMANENT STAF OF LIVING LAB** (e.g. consultants, health care professionals, high level medical personnel, steering group for innovations)	3,00	4,40	8	1,40	*
9	**IPR PORTFOLIO** (e.g. patents and trademarks)	1,93	3,00	9	1,07	*

|	VALUE PROPOSITION	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	**R&D SERVICES** (e.g. research services (developmental), to test equipments and tool in real environment, research and development of medical robotics, research with R&D and regional development, refinement in various product dev phases)	5,80	6,60	1	0,80	
2	**UNIQUE INFRASTRUCTURE** (e.g. unique testbed for devices and healthcare data solutions, Unique test setup for technical and user elements, Facilities and technology available for partners, Access to novel equipment and research services, Access to public facilities and resources)	5,53	6,60	2	1,07	
3	**R&D AND/OR TESTING WITH REAL END-USER** (e.g. app testing on patients before launching on IT-platform, Everyday teamwork with patients and families, Fast access to agile piloting with users, Organizing test groups for companies and their products, User and customer feedback, usability)	4,87	6,40	4	1,53	*
4	**VARIOUS POSITIVE ARGUMENTS** fast development, Cost effective LL development, high quality research, long-term and wide-range experience, reliable partnership for cooperation	4,33	6,47	3	2,13	**
5	**CUSTOMIZED AND PERSONALIZED SERVICES** (e.g. Personalized wellbeing services, Custom-made assisstance for collaborative projects, adjustments of test apps, sustainable concept or solution tailored to custom needs)	4,07	4,87	5	0,80	
6	**MULTI-DISCIPLINARITY** (e.g. Inter-professional testing at different development phase, ensuring multidisciplinary development, Testing according to international protocols and validation)	4,07	5,80	8	1,73	*
7	**ECOSYSTEM AND PROJECT MANAGEMENT** (e.g. single point entry by customers to access partners, Orchesterating innovation ecosystem, Partner identification, One point for all questions, Project management)	3,87	5,07	6	1,20	
8	**VALUE AND IMPACT EVALUATION** (e.g. Healthcare economics, Determination of potential value of cooperation, Sparring and analytical support)	3,73	5,07	7	1,33	*
9	**FUNDING SUPPORT:** (e.g. Feedback on project applications, being a partner or finding a partner for projects)	3,60	4,60	10	1,00	*
10	**EDUCATION AND TRANING** (e.g. updating professional competence, distribute latest info about the technologies, safe simulated learning environment (medical), Seamless integration with education and LL/SD activities)	3,20	4,73	9	1,53	*
11	**METHOD DEVELOPMENT** (e.g. new scientific discoveries to improve LL / CC / SD methods and pedagogy)	3,07	4,00	11	0,93	*
12	**MARKETING SUPPORT** (e.g. develop visibility of medical services for medical institutions)	2,40	3,33	12	0,93	*
13	**GRANT FUNDING** (e.g. providing full or partial funding of customer innovation project)	2,33	3,13	13	0,80	

	CUSTOMER RELATIONSHIPS	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	**LONG-TERM RELATIONS** (e.g. existing long-term contacts and relations, Partner for manufacturers, Permanent and non-permanent agreements with internship providers, institutional relationships)	6,20	7,53	1	1,33	
2	**PROJECT BASED** (e.g. project and need based collaboration based a defined project consortium)	5,93	6,73	2	0,80	
3	**DIRECT PERSONAL CONTACTS** (e.g. email, phone, face-to-face, skype)	5,53	6,47	3	0,93	
4	**NETWORKING** (e.g. networking / collaborating with other innovation, research and industry actors)	4,87	6,33	4	1,47	*
5	**EVENTS** (e.g. National and International events)	3,80	4,93	6	1,13	
6	**(7) INTERNAL** (e.g. Internal business supporting projects within own organization or with hosting organization of the Living Lab)	3,80	4,47	7	0,67	
7	**(9) CO-CREATION WITH VARIOUS STAKEHOLDERS** (e.g. co-creation and collaboration with various communities)	3,67	6,07	5	2,40	**
8	**(8) STEERING** (e.g. Ministry of Educations, owners or other stakeholder are actively steering the Living Lab activities)	2,87	3,67	8	0,80	*
9	**(6) ADVISORY** (e.g. Your Living lab personnel is acting as a business advisory for potential customers or vis-versa)	2,73	3,47	9	0,73	*

	CHANNELS	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	CO-OPERATION PROJECTS (e.g. participating as a partner or coordinator in projects, co-operation partners, other innovation actors)	5,47	7,07	1	1,60	*
2	DIRECT CHANNELS (e.g. direct marketing, direct contacts, personal contacts, email, word of mouth)	4,87	6,33	2	1,47	
3	REGIONAL CHANNEL (e.g. official regional inter- and intranet channels or other similar channels managed by regional authorities)	4,47	4,93	7	0,47	
4	EVENT PARTICIPATION (e.g. participating in events, fairs and conferences either as a participant or presenter)	3,93	5,27	5	1,33	
5	EDUCATIONAL CHANNELS (e.g. degree programs and individual courses, training courses in simulation, Internship as a part of studies)	3,80	4,47	10	0,67	
6	NETWORKS AND CLUSTER (e.g. national and international networks, Scanbalt promotion list, ENoLL)	3,73	5,93	3	2,20	*
7	EVENTS ARRANGED BY LIVING LAB (e.g. hosting and arranging own conferences and events, annual events for selected stakeholders, workshops, customer journey meetings)	3,40	5,40	4	2,00	*
8	OWNER'S OR KEY PARTNER'S CHANNELS (e.g. owners or other key partners own communication and marketing channels)	3,27	4,13	12	0,87	
9	PROFESSIONAL PUBLICATIONS (written by Living lab personnel to describe Living Lab activities and result to professional audience)	2,80	5,20	6	2,40	**
10	MUNICIPAL AND CITY CHANNELS (e.g. official channel managed by municipal or city or other similar channels managed by local authorities)	2,80	4,40	11	1,60	*
11	PEER REVIEWED SCIENTIFIC JOURNAL OR CONFERENCE PUBLICATIONS (e.g. articles disseminating the scientific knowledge of Living Labs)	2,73	3,47	8	0,73	
12	LOBBYING AND POLICY CHANNELS (e.g. public sector policy and strategy papers and recommendations, advisory meetings, Information meetings with hospitals and administrative)	2,73	4,80	13	2,07	*
13	ONLINE, MOBILE AND SOCIAL MEDIA (e.g. web and mobile sites, social media services, youtube and other similar digital services)	2,40	4,73	9	2,33	*
14	STATE LEVEL CHANNEL (e.g. official state level inter- and intranet channels or other similar channels managed by state authorities)	1,93	3,13	14	1,20	*
15	PAID MEDIA PROMOTION AND MARKETING (e.g. newsletters, media, printed media, PR)	1,20	2,40	15	1,20	*

	REVENUE STREAMS	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	PROJECT GRANTS (e.g. Grants received from national and international funding calls such H2020, Interreg, European Social Fund. European Regional Development Fund)	6,67	6,33	2	-0,33	
2	BASIC FIXED (OR PERMANENT) FUNDING (e.g. basic funding from owners, investors, public authorities or other similar actors who have committed to funding Living Lab activities beyond single project. Including municipal or regional fixed grants, or internal funding from hosting organization, annual fees from customer)	5,07	6,40	1	1,33	*
3	R&D PROJECT AND CONSULTING SERVICE SALES (e.g. contracts and invoicing from executing R&D projects or consulting services, organizing test groups)	2,00	3,33	3	1,33	**
4	EDUCATION AND TRAINING SERVICES (e.g. training course fees, examination fees, certification fees)	1,67	2,40	4	0,73	*
5	DEVICE AND INFRASTRUCTURE RENTAL (e.g. Rental living lab, truck, equipment)	1,33	2,27	5	0,93	*
6	DONATIONS (e.g. Individual or institutional donators)	1,13	2,27	6	1,13	*
7	ROYALTIES (e.g. Royalties from IP properties or elsewhere)	0,80	1,73	7	0,93	*
8	EVENT AND SITE VISIT FEES (e.g. Visit to the Living Lab facilities, events, and workshops)	0,73	1,60	8	0,87	*
9	EQUIPMENT AND DEVICE RETAIL (e.g. selling equipment and devices)	0,40	0,53	9	0,13	

	CUSTOMER SEGMENTS	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	EDUCATION ORGANIZATION (e.g. educational institutions, universities, students, teachers)	4,40	5,20	3	0,80	
2	REGIONAL PUBLIC ORGANIZATION (e.g. Regional support and administrative departments, regional council, regional government)	4,40	4,93	5	0,53	
3	TANGIBLE EQUIPMENT AND DEVICE MANUFACTURERS AND INDUSTRY PARTNERS (e.g. companies/Industry partners, International mHealth/IT industry, long term company relationship, SMEs, medical devices and equipment providers, industry experts (groups)	4,13	5,27	2	1,13	*
4	E-HEALTH, M-HEALTH AND DIGITAL SERVICE PROVIDERS AND DEVELOPMENT COMPANIES	4,00	6,27	1	2,27	*
5	RESEARCH ORGANIZATION (e.g. research institutions, universities, national research centers and institutes, research councils, researchers experts).	3,93	4,53	8	0,60	
6	SECONDARY CARE ORGANIZATION/UNITS (e.g. health services provided by medical specialists and other health professionals for inpatients on referral from a primary health professionals)	3,80	4,53	7	0,73	
7	MUNICIPALS AND CITIES (e.g. administrative and development departments)	3,80	4,67	9	0,87	
8	PRIMARY CARE ORGANIZATION/UNITS (e.g. health professional organizations who act as a first point of consultation for all patients within the healthcare system).	3,27	4,80	6	1,53	*
9	STATE LEVEL ORGANIZATION (e.g. State budgetary unit, Health data authority)	3,07	3,33	12	0,27	
10	NETWORKS AND CLUSTERS (e.g. Company cluster organizations, Company networks, international partners and networks, cluster members, ecosystem partners, Life science cluster, accelerator, life science innovation, affiliated LLs)	3,00	5,00	4	2,00	*
11	TERTIARY CARE ORGANIZATION/UNTIS (e.g. specialized higher level consultative health care within the hospital, usually for inpatients and on referral from a primary or secondary health professional)	2,33	3,80	11	1,47	*
12	PREVENTIVE HEALTHCARE, WELLBEING AND WELLNESS SERVICE PROVIDERS (e.g. fitness centres, gyms, coaching, personal training, spa, beauty services, physiotherapy)	2,07	4,47	10	2,40	**
13	NGOs, NPOs and THIRD SECTOR ORGANZIATIONS (e.g. 'value-driven' organizations promoting, supporting or serving specific objective(s) or causes including such as patients associations, senior associations)	1,47	2,80	13	1,33	*

	COST STRUCTURE	Mean Current	Mean 2021	Rank 2021	2012 - Current Mean diff.	Mean Diff. Sig.
1	PERSONELL (e.g. all personnel related expenditure including salaries, human resource management, administrative costs, internship fees)	7,53	8,07	1	0,53	
2	INFRASTRUCTURE AND FACILITIES COST (e.g. all facilities, technical environments (rent), equipment, amortisation of equipment, (software) licences, ICT infrastructure outsource expenditure, depreciation of the truck, utilities costs, common costs, memberships fees, distribution and hosting costs fees in networks)	4,13	5,53	2	1,40	*
3	OWN INTERNAL R&D DEVELOPMENT (e.g. software, process, concept, or other similar tools development which are required to run or improve Living Lab activities)	3,13	4,80	3	1,67	*
4	TRAVELLING COSTS	2,67	3,20	6	0,53	
5	CONSULTING FEES FOR INDIVIDUAL EXTERNAL EXPERTS (e.g. all external experts including health and wellbeing, legal, IPR, innovation management etc.)	2,27	3,07	7	0,80	
6	IPR PROTECTION (e.g. Patents and IPR protection)	2,20	2,60	8	0,40	*
7	END-USER FEES AND OTHER VARIABLE COSTS RELATING LIVING LAB ACTIVITIES (e.g. arranging LL activities, payments for end-user participation, reagents, materials and consumables)	1,93	3,40	5	1,47	*
8	COSTS RELATING OUTSOURCED SERVICES (e.g. all other professional services excluding the infrastructure, facility or individual expert costs)	1,87	2,60	9	0,73	
9	MARKETING AND SALES (e.g. Marketing, communication, customer and end.-user acquisition costs, engaging users, own share of external funded projects, conference and event participations)	1,73	3,47	4	1,73	**
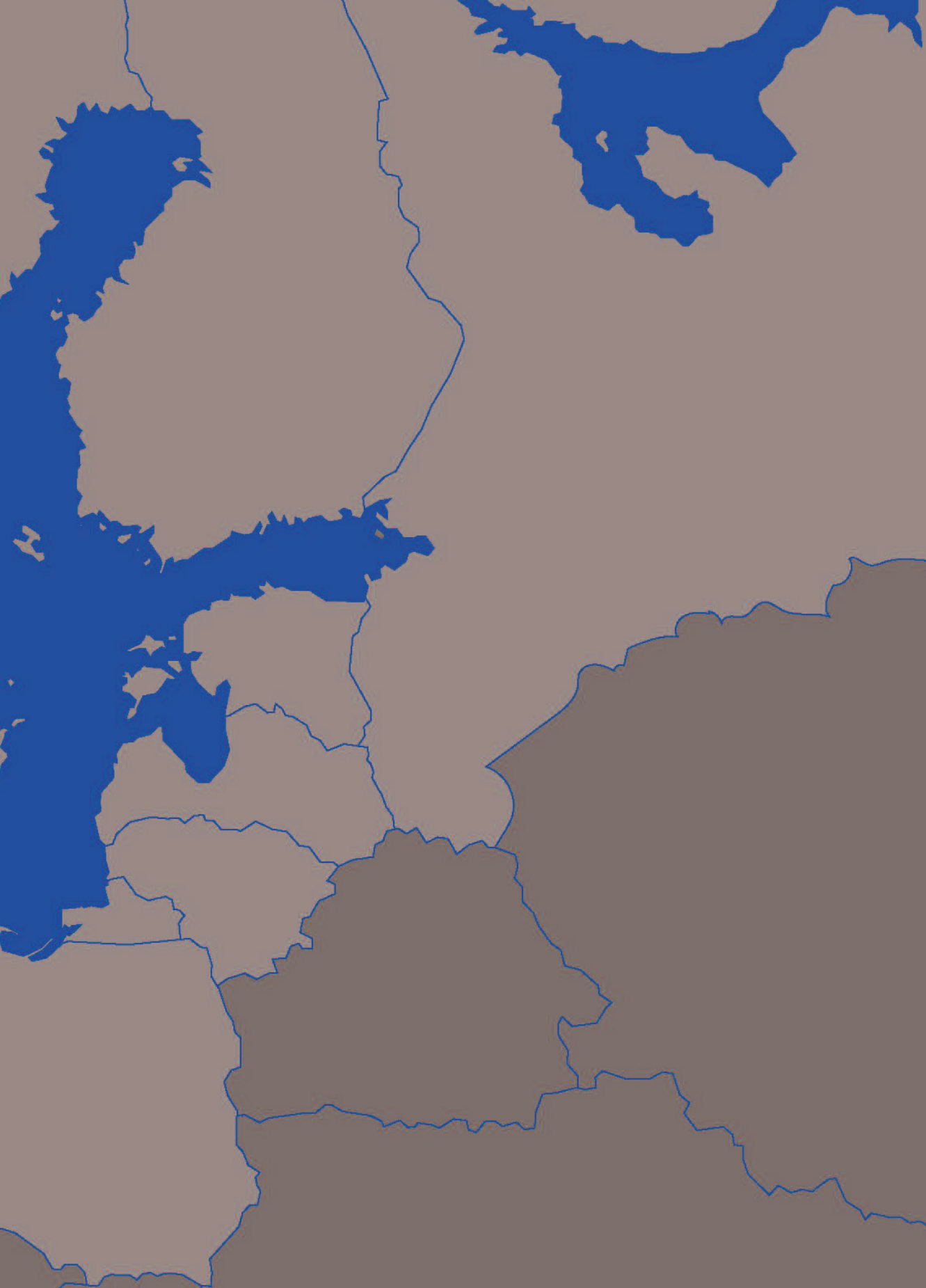
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Product Validation in Health (ProVaHealth) was an Interreg Baltic Sea Region funded three years project (October 2017 to March 2020) to stimulate collaboration between fifteen health and wellbeing living labs across the Baltic Sea. Living lab by definition is a multi-stakeholder driven user-centered open innovation approach to co-create and test novel solutions in real-life environments. This report presents the key findings regarding the development efforts to co-create sustainable business models and services for living labs to support SMEs and start-ups internationalization efforts.