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Health and welfare technology companies' needs and wishes related to living lab/testbed services

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Abstract
The study aimed to describe the knowledge health and welfare technology companies have about living labs/testbeds and to analyze companies' needs and wishes related to living lab/testbed services. Exploring the health and welfare technology companies' knowledge, needs and wishes enables the providers of living lab/testbed services to develop their services to benefit companies. This allows the companies to create better products and services for both healthcare professionals and patients, leading to cost-effectiveness and saving resources in the healthcare sector. A survey was thought to be a suitable method to study this.

A questionnaire was sent out to 41 health and welfare technology companies in the Satakunta area. The questionnaire contained both open-ended and close-ended questions. Descriptive statistics were used to analyze the quantitative data and conventional content analysis to analyze the qualitative data, i.e., the data from the open-ended questions. Since there were not that many answers to the open-ended questions, the coding was done manually.

The results indicated that there is not enough information available about living lab/testbed activities in Satakunta and that the health and welfare technology companies operating in the Satakunta area are not that familiar with the living lab/testbed concept either. The companies need help at the end of the product development phase with testing a ready product, acquiring scientific references for their product, and expanding the product's target group.

The living lab/testbed services providers should make information about their activities available, using an electronic newsletter, their web page, and LinkedIn. More information about the different options that the living labs/testbeds can provide, could also make the companies more interested in allocating money to living lab and testbed services.

Keywords
Living lab, testbed, health and welfare technology companies, product development in healthcare.

CONTENTS

1 INTRODUCTION

An aging population, an increased shortage of healthcare personnel, and the demand for equality in access to healthcare continue to create challenges for the healthcare sector today. Eurostat (2021) estimates that in the current EU member states, the population aged sixty-five and over will rise from 90.5 million in 2019 to 129.8 million by 2050. Add to this, over fifty million people in Europe have more than one chronic disease according to Brennan et al. (2017).

According to the European Commission, 21 of 30 countries are reporting a shortage of nurses. In Finland, according to the TE-services indicator (2021), nursing associate professionals will continue to be one of the occupations with the greatest demand in the labor force in the following six months. This will result in less social- and healthcare staff that is expected to take care of more patients in the future, and the question remains; how will we provide cost-effective, equal, and high-quality care to everybody?

Gjellebæk et al. (2020) state that digitalization and e-health are part of the solution to the current challenges in healthcare. A report issued by the Ministry of Social Affairs and Health (2016) describes how digitalization in healthcare will change the way work is done in healthcare by digitizing internal processes and services. This will make it possible to curb the costs of social- and healthcare. Thus, digitalization in healthcare is part of the solution to the challenges.

Garmann-Johnsen et al. (2020) conclude that to cope with the aging population, the process of digitalization needs to be sped up to maintain a sustainable level of the quality of healthcare services. This cannot be done without involving the employees. Matinolli et al. (2019) found that nurses' expertise could be utilized more in healthcare product development.

To speed up the digitalization and develop services and products in the healthcare sector, the involvement of companies is needed. Reunanen et al. (2020) describe that in health technology, the development of products and systems can be a long and

sometimes complicated process, and the idea of a rapid path from idea to business might seem impossible.

Living labs/testbeds offer companies the chance to test products, services, and systems in a real environment. Feedback received at an early stage is beneficial for rapid product development and, as Lepik and Krigul (2021) point out, prevents innovation failure. Santonen (2020) concludes that digital service providers and device manufacturers are the two customer segments that will be most interesting for living labs in the future.

This work begins with describing the aim of this study. It continues with a definition of living lab and testbeds, a description of living lab/testbed activities in Finland and the benefits of co-operating with a living lab/testbed in chapter 3. After this, the special features of product development in healthcare will be described in chapter 4. Further, in chapter 5, the methods of this study will be described. Then the results of the study will be presented in chapter 6 and discussed in chapter 7. This work ends with a conclusion in chapter 8, with suggestions for improvement as well as suggestions for further studies.

2 AIM AND RESEARCH QUESTIONS

This thesis aimed to describe the knowledge health and welfare technology companies have about living labs/testbeds and to analyze companies' needs and wishes related to living lab and testbed services. By exploring the health and welfare technology companies' knowledge, needs, and wishes, the providers of living lab/testbed services can develop their services in a way that benefits the companies. This allows the companies to create better products and services for both healthcare professionals and patients, leading to cost-effectiveness and saving resources in the healthcare sector.

There have been many case studies done about the practical implementation of living labs and testbeds in the healthcare sector (Kim et al., 2020; Nishdia et al., 2017; van den Kieboom et al., 2019), about the living lab as a concept (Orava, 2009; Santonen, 2018) and about the benefits and challenges in using living labs (Eschenbächer et al., 2010; Hakkarainen & Hyysalo, 2013). Also, studies and articles exploring the user's role in the living lab setting (Arnkil et al., 2010; Hakkarainen & Hyysalo, 2013; Westerlund et al., 2018) have been done. But there are only a few studies that have analyzed the companies' needs and wishes regarding living labs and testbeds (Haukipuro et al., 2019; Holappa, 2018; Vertanen, 2019).

Therefore, this thesis helps to clarify the needs and wishes of health and welfare technology companies from living labs/testbeds.

The research questions were:
What do companies know about living labs/testbeds?
What kind of living lab and testbed services would support the companies in the product development process?
The purpose of the study was to help living labs/testbeds develop the services they provide according to the needs of the companies.

This thesis sought to help living labs/testbeds to better meet the needs and wishes of different companies that operate or wish to operate in the health care field making it possible for the living lab/testbed concepts to expand in Finland. This improves patient

care in both the public and private healthcare sectors, as new products, services, and systems will emerge that benefit the patients while aiding the healthcare sectors in their challenges. The importance to explore what companies want from testbeds was also recognized by the national testbed network in Finland (Miettinen et al., 2021).

3 LIVING LABS AND TESTBEDS

3.1 Definition of living labs and testbeds

The European Network of living labs (ENoLL, 2021) defines a living lab in the following way: "*Living Labs are 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."* The collaboration in a living lab takes place in a real-life environment, where end-users participate as equivalent partners with other participants, to develop products or services for themselves and other end users.

The term living lab originates from MIT (Massachusetts Institute of Technology), according to Ballon and Schuurman (2015), and the term was used to describe a purpose-built lab. It was possible to monitor, record, and experimentally manipulate everyday activities of home life in the lab, and the volunteer research participants treated it as their temporary home.

Currently, living labs are described as "highly promising, user-centered, open innovation systems that integrate research co-creation and knowledge exchange in real-life settings. Living labs involve a designated space (i.e., virtual, or physical), generally to leverage stakeholder collaboration and shared ideation to solve social problems." (Archibald et al., 2021, p. 2.) Living labs consist of five key elements. These are multimethod approaches, multiple stakeholders, the engagement of users, real-life settings, and the co-creation of an innovation environment. (Archibald et al., 2021.)

Merriam-Webster (2022) defines a testbed, in a broad sense, as *" any device, facility, or means for testing something in development*." Rönkä and Orava (2007) describe how testbed services or products are tested in a controlled, laboratory liked setting, and more often used for research purposes. End-users and product/service suppliers have an assisting role in this case. van Geehuizen (2015) suggests that the activities

can be referred to as a testbed when the user only passively forwards opinions and experiences and is not a co-creator in the development process.

Santonen (2018) found that amongst scientific publications written in English, testbed is by far the most popular term used. Citizen science and community-based participatory research are close seconds. Innovation lab, design lab, and government lab were also more popular search terms than the term living lab. Only the terms living lab and testbed were interlaced in a substantial way, which manifested itself with a reference or remark to testbeds in almost twenty percent of living lab publications.

In Finland, the terms living lab and testbed are used interchangeably. Here the terms are mostly used to describe the kind of platforms that offer companies a setting for testing their products, systems, and services in a real or simulated environment. This study equals the terms living lab and testbeds with each other and will refer to their operations as living labs/testbeds. When referring to literature, the term used by the authors, living lab or testbed, has been used.

3.2 Features of living labs/testbeds

Living lab operations is the collaboration between multiple stakeholders and strives to engage users. van Geenhuizen (2015) describes user involvement as ranging from users acting as leading co-creators to users being passively involved by only forwarding their preferences and experiences with the product/service. Other stakeholders that can be involved in living lab activities are universities and research institutes. They provide their knowledge and co-creation and have a desire to solve societal problems and adopt a responsible role in society. Providing the setting for a living lab can assist with this.

van Geenhuizen (2015) describes how both large and small companies can be stakeholders in a living lab setting. They wish to receive the user's feedback and co-create with these to create new products/services of better quality. Financial institutions can be part of a living lab where they invest in a promising living lab or project in a living lab that has a new product/service that is gaining satisfactory results

and is, therefore, worth the investment effort. Sometimes municipalities or other public authorities are involved, they can be a leading actor, a neutral actor, or the facilitator of the living lab and can function as both owner and user.

Ståhlbröst (2012) introduces a few key principles which should be infused in all living lab operations: value, sustainability, influence, realism, and openness. In this work, the focus is on value, realism, and openness. The main idea is to find out what kind of living lab and testbed services would support and provide value for the companies in the product development process.

Different stakeholders deal with different realities, for example, a company's main priority might be to earn money, whereas the researcher might want to achieve scientific results. This, in turn, is an argument for involving different stakeholders in the development process. Openness means being able to work in an environment with different stakeholders, which requires various levels of openness, and willingness from the companies to share their innovation process.

3.3 Living lab/testbed activities in Finland

Kielo-Viljamaa (2021) has mapped testbed activities in Finland, to create an overall picture and describe the maturity of said activities. The term testbed is used in the report, but she mentions that the term used varies between areas and organizations and that living lab, test lab, and innovation place are also commonly used.

Niemelä and Sachinopoulou (2019) mapped how artificial intelligence and robotics that support living at home are piloted and tested in Finland by using authentic environments for co-development and testing with real users. Here the term living lab is described as a user-centered, open innovation ecosystem that belongs to the ENOLL-network. Testbed activities are described as focusing more on medical treatment and development of hospital environments and being provided by university hospitals or hospital districts. The term pilot environment is used in the report to describe both living lab and testbed activities.

Kielo-Viljamaa (2021) concludes that testbeds in Finland are an established part of university hospitals and universities of applied sciences activities. Äyväri and Hirvikoski (2021) have also done a review of innovation platforms, in this case living labs and testbeds, in Finland. They state that one or more universities of applied sciences are active contributors to all the innovation platforms in the review.

Kielo-Viljamaa (2021) describes how universities of applied sciences co-operate with healthcare providers and provide services with a "one-stop-shop" principle. The benefits of this kind of centralization of services are the possibility to combine strengths and knowledge, and less bureaucracy. There are also some regional specializations amongst testbeds in Finland, for instance in imaging, drug development, and robotics. Niemelä and Sachinopoulou (2019) observed that there is not any national co-operation between the pilot environments. Äyväri and Hirvikoski (2021) also suggest there could be more co-operation between different innovation platforms in Finland.

Kielo-Viljamaa (2021) points out that testbeds are also developing towards a more business basis form of activities, especially the universities of applied sciences, but also among providers of healthcare services. Limited resources seem to be one of the biggest challenges for testbed activities. Niemelä and Sachinopoulou (2019) found that the co-creation and pilot activities were mainly funded by project grants and that this makes it hard to establish the activities of the piloting environment once there is no more funding.

Kielo-Viljamaa (2021) also met with representatives of different health technology companies and asked them what their needs and expectations were regarding testbeds. The companies stressed the importance of visible pricing for the testbed's services and a definition of the testbed, particularly regarding the content of the testbed services. In Niemelä and Sachinopoulou's (2019) study the companies mentioned the opportunity to get new information about the users' needs and finding new users or areas for usage as important.

Other aspects mentioned by the representatives in Kielo-Viljamaa's (2021) study were practical things related to the testing, such as things related to scheduling, contractual

aspects, the roles of the participants, communication channels, and available resources. Further, a thorough report of the testing, feedback regarding the service or product, and the possibility to follow the project's progress continuously were essential. The companies also valued informative marketing regarding the services provided and a clear and quick answer to contacts made by the companies.

3.4 Benefits of and downsides to participating in a living lab/testbed

There are many benefits for small and medium-sized enterprises (SMEs) to participating in living lab/testbed operations. Niitamo et al. (2012) mention that larger companies want to partner with smaller firms in open innovation settings because they have access to newer technology. Small firms need to consider that besides involving users, they would also benefit from involving other market players and research organizations because small firms don't necessarily have enough personnel. Trust among partners is vital in living lab settings. Multiparty partnerships can help small firms develop, validate, and integrate new ideas, and speed up and enlarge the launching to a global market.

Lepik and Krigul (2021) introduce three types of support living labs can offer to SMEs. These support the companies in speeding up the commercialization process and building up the innovations and products, the chance to get validation and feedback directly from the customer, and input in product development. In their study on the expectations and needs of the Estonian health sector, SMEs from living labs in an international context the SMEs had some needs in product development such as testing and validation. Especially validation according to medical regulations and CE certification. Regarding product development, the SMEs expected the living labs help to find something unexpected or extraordinary regarding the product. The fact that the SMEs participating in the study had products that were in the marketing or validation phase already, might have affected the perceived need for co-creation with living labs.

Further, Lepik and Krigul (2021) also found that internalization was a vital need for all companies. They all wished to take their product abroad, and related to this, finding

a suitable partner, lack of clinical evaluation, and, both local and EU legislation were mattering the companies struggled with. Lepik and Krigul (2021) suggest that a network of living labs could be a solution to finding a suitable partner and assisting with legislation issues.

Haukipuro et al. (2019) found that the finalists in the Future Internet CHallenge eHealth (FICHe) accelerator benefitted from using the living lab approach. It was seen as a vital part of product development, especially in the final part of making the product ready for the market. The feedback the companies received from the customers led to new features in their products, new business and contracts, better visibility, and ways of marketing the solution.

Holappa (2018) examined the effects of the living lab tests on the product development of technology companies. She found that living lab product tests were more challenging than the companies' own tests. The testing demonstrated developments in the service needed and aided with content design. The collaboration gave the companies more information about the target groups' needs and made it possible to find new target groups and adapt the service to them. It also produced more information about the social- and healthcare sector activities and processes. The testing added to the recognition of the services and sped up the welfare technology innovations product development, saved economic resources in product development, and boosted commercial co-operation with healthcare organizations.

The significance of the participation of real customers and social- and healthcare personnel and the importance of the development of technology innovations was highlighted in the feedback from the companies' representatives in Holappa's (2018) study. The technology companies felt that the testing also could be used as a reference and that it offered support for the marketing and communication of the service. The collaboration in a living lab also resulted in new networks related to the testing as well as non-related.

Knudsen and Mortensen (2011) also found some downsides to openness and open innovation, as openness might slow the product development process down and make it more expensive. This slows down time to market when comparing product

development results to the closed innovation model, where the product development takes place inside the firm. Hakkarainen and Hyysalo (2013) discovered some challenges that can occur when co-operating in a living lab setting. There is a possibility that power issues can emerge between the different stakeholders, and that the end-user is not motivated to participate in the development of new technology.

4 PRODUCT DEVELOPMENT IN THE HEALTHCARE SECTOR

4.1 Product development process in healthcare

In today's business environment, where customers, technologies, and competition change in a rapid way, Xin et al. (2010) state that firms need to renew themselves frequently to survive and succeed. The primary means to a firm's renewal is the development of technologically innovative products.

There are numerous product development processes available. Trott (2017, p. 498) describes a commonly presented linear model of new product development (NPD). This model starts with idea generation, idea screening, and concept testing, followed by business analysis, product development, test marketing, and commercialization, and is finalized by monitoring and evaluation.

Schuurman et al. (2016) propose an approach to product development in living labs based on the NPD stages. The services the living labs provide can be divided into three categories. These are the exploration phase, which is the idea and concept phase of NPD, the experimentation phase with the prototype phase, but also the whole NPD chain. The last category is the evaluation phase, which contains prelaunch, launching, and post launching services.

In Finland, Seppänen et al. (2020) describe how the Elsa Testbed project distinguished three separate phases of product development where the company could benefit from the testbed's services. The first phase is the ideation phase, where the product is still in the ideation phase or early prototype phase, and the company needs more information or validation if the product is suitable for the healthcare sector and its environment. This phase also provides mapping partners together or can be a channel for searching for financing. This phase involves different healthcare sector experts, personnel, and students as well as company representatives.

Seppänen et al. (2020) continue by describing the second phase, the development phase, which is the phase where the company already has a clear product development

idea. In this case, the planning, manufacturing, and testing of the prototypes are offered, or if the company already has an early prototype, testing of the product (or service) is provided. The test group consists of students, experts in the field, or the end customers. The services in this phase are usually provided in a simulation environment since the product or service still is not developed enough to test in an authentic environment.

The last phase is, according to Seppänen et al. (2020) the testing/validation phase. This is where almost ready products can be tested in an authentic healthcare environment. The testbed personnel choose the right testing environment for the testing and organizes the testing together with the healthcare sector personnel. They also analyze the results after the testing and provide a report of the results.

Santonen (2020) suggests that before the living lab process starts, there should be a briefing session where the customers' needs are clarified. If the customer chooses to co-operate with the living lab after the briefing, it is followed by the making of a project plan in which costs, period, and the research design of the living lab are stated. This eventually leads up to a project proposal, which proposes to do a certain amount of work, in a certain amount of time for a certain price. Further, the process itself contains a need, challenge, and opportunity identification phase, where the market and user needs, and challenges are discovered and defined.

This is followed, as Santonen (2020) describes, by idea generation and idea testing, where a variety of ideas are generated in co-creation and then tested. In the concept and prototyping phase, different concepts are co-created with users and other stakeholders, and one concept is selected for full development. The detailed product and service development phase is where a fully functional solution is developed with the input from end-users and other stakeholders as needed, which then is tested in small-scale testing before taking the product to larger-scale testing. This is followed by the validation and impact phase, where the fully functional product or service is validated in a real-life environment, with real users. The last phase is market launch and post-market, where the product is made available on the market and feedback is collected for the next revision of the product/service.

4.2 Guide for product development in healthcare

In healthcare, some special requirements need to be accounted for in the product development process. Tekes (2015) has published an eight-step guide with recommendations for product development and launching in the healthcare sector. It is recommended to start by defining the device's purpose, for who it is designed, and what kind of medical problems it is intended to solve. It is also important at this stage to think about how the product is going to be sold, and marketed and where, i.e., in which countries.

Defining whether the device, app, or software can be classified as a medical device according to the Medical Device Regulation (MDR) 2017/45/EU is crucial at this stage because it affects the whole product development process. The regulation is based on a high level of protection of patients' and users' health, whilst also accounting for SMEs that operate in the healthcare sector. The regulation also sets high quality and safety standards for medical devices to accommodate concerns for such products' safety.

According to MD 2017/745/EU, the regulation regards all medical devices i.e., any instrument, apparatus, appliance, implant, material, reagent, or software, which is intended to be used for special medical purposes on human beings. The intended purpose includes diagnosis, monitoring, prevention, treatment, or alleviation of a disease, injury, or disability. Also included is if the medical device strives to investigate, replace, or modify the anatomy or a psychological or pathological process or state. Devices that control or support conception and devices for cleaning, disinfection, or sterilization of medical devices also fall under this category. Besides this law that applies to all medical devices, depending on the product, there might be other laws that need to be applied, for example, directives regarding medical records.

Depending on the product, there might be other laws and regulations that need to be considered according to Tekes (2015), and observing these are the second step in the process. This might be for example laws that regulate how patient information can be handled.

If the product is considered a medical device, it is also important to define whether it belongs to classes I, IIa, IIb, or III. This is the third step in the process. The class is decided according to the possible risks of the device. Class I devices are devices that do not touch the patient or only come in contact with intact skin. In general, all non-invasive devices belong to this category, for instance, hospital beds, non-invasive ECG electrodes, and conductive gels. There are a few exceptions, if the device is storing, channeling, or treating blood or other liquids or if liquids are returned to the body or generating energy delivered to the body and hereby affecting internal psychological processes, the device is not considered a class I device. (European Commission, 2010).

Medical devices in class IIa are considered to pose a medium risk. In general, these are invasive devices, which penetrate inside the body, or are surgically invasive, that are limited to natural openings in the body, and are intended for short-term use under 30 days. Active therapeutic devices, which administer or exchange energy, or for diagnostics fall under this category as well as active devices that remove or administer body liquids, medicines, or other liquids to or from the body. Also, software that is used to make diagnoses or for therapeutic purposes belongs to this class, unless the decision could cause death or deterioration of a person's health, in which case it belongs to class III. Other software is considered class I. (European Commission, 2010).

Surgically invasive devices that are intended for long-term use over 30 days and implantable devices are considered IIb class devices, examples include urinary catheters intended for long-term use, long term corrective contact lenses. If an active device exchange or administer energy in a hazardous way, it might belong to class IIb. (European Commission, 2010).

Medical devices in class III pose the highest risk for patients. These are surgical invasive-, long- or short-term use devices, and implantable devices that are used in direct contact with the heart or central circulatory/nervous system, for instance, cardiovascular catheters. These are also devices that go through a chemical change in the body or administer medicine. Breast implants, hip, knee, or shoulder implants, and intrauterine long-term contraceptives also fall under this category. If the device is made utilizing human or animal tissue, is intended to be absorbed by the body whole

or mainly, or has a biological effect, it belongs to category III. (European Commission, 2010).

After defining the devices' purpose, it is time for the fourth step, recognizing requirements. This can be described as doing everything necessary to make sure that the product is suitable for its purpose during its lifecycle, whilst making sure that you can take care of possible adverse events, despite the product class. In this phase it might be beneficial to get to know the different harmonized standards for medical devices provided by the EU, often ISO or ECT standards. (Tekes, 2015).

The fifth step includes, according to Tekes (2015) demonstrating the compliance of the medical device, i.e., that the device is safe for use and fulfills its purpose and the directive's requirements. This is done by the conformity assessment, where the manufacturer takes responsibility that the product fulfills all the requirements for the specific product according to the MDR. Matousek (2018) presents that the conformity assessment requires technical documentation of the product characteristics, set up according to annex II and III in MD 2017/745/EU, this is mandatory for all manufacturers, regardless of medical device class. According to yourEurope (2021), this also needs to include a risk assessment of the device.

For medical devices in class I, the manufacturers can, according to Matousek (2018) declare the conformity themselves, and then affix the CE-marking. Manufacturers of devices that belong to classes IIa, II b, or III need to create a quality management system according to the MDR, it is a good idea to create the Quality Management system based on the standard ISO 13485:2012. Then the QM system needs to be assessed by a notified body, examples of notified bodies can be found in the NANDO database. The notified body then performs audits at least every 5 years to make sure that the manufacturer applies the quality management plan and the post-market monitoring plan, which is part of the technical documentation according to MD 2017/745/EU. Some IIb and III devices require an assessment by an expert panel, based on the clinical assessment report of the notified body (European union, 2018).

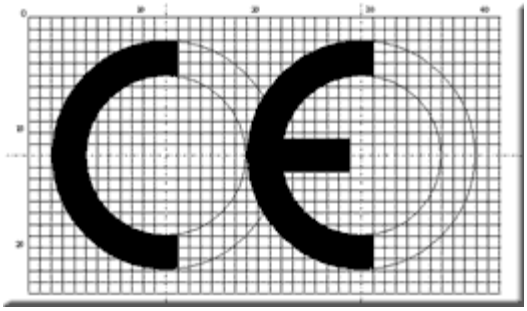

Figure 1. CE. European Commission. (2021)

The declaration of compliance is, according to the Tekes (2015) guide the sixth step, crucial for the mandatory CE marking that is required for all medical devices. The CE marking, seen in Figure 1, should be affixed to the product or to the packaging if not possible to affix it to the product according to yourEurope (2021). When the product has acquired its CE marking it can be registered with Fimea, which is the seventh step. Then the product is ready for launch. The eighth and last step is an ongoing process during the whole life cycle of the product and includes managing and the manufacturer is responsible for every product until the last product has left the market.

5 RESEARCH METHODS

5.1 Conducting the study

This study uses a quantitative research design to explore the needs and wishes of health and welfare technology SMEs located or operating in the Satakunta region. This is done to be able to generalize the results to a larger population, which, according to Groves et al. (2009), defines a survey.

When conducting a survey where time, resources, and access to people are limited, Punch (2003) implies that the researcher might need to settle for a smaller sample, and a convenience sample will be used as a sampling method. It is important to consider what the sample would be in an ideal world and why, and what is feasible with the current resources. In this study, a digital questionnaire was sent to different 41 health and welfare technology companies located or operating in the Satakunta region, e.g., the companies who have collaborated or planned to collaborate with living lab and testbed environments in Satakunta University of Applied Sciences, Prizztech Oy, Sataedu, or WinNova.

As part of the survey, Kokeilimo wished to receive feedback from the companies that already had used their services. Kokeilimo is a homelike space at Satakunta University of Applied Sciences where companies can rent a space for displaying their products to potential customers and the customer also can test the products. Kokeilimo provides an opportunity for companies to display their products and do user testing/surveys in Kokeilimos spaces. Kokeilimo also provides the service of doing user testing/surveys for the company and for customers to rent the company's products.

Of the 41 companies, 12 had collaborated with Kokeilimo and they received a version of the questionnaire with nine additional questions concerning their co-operation with Kokeilimo. The companies who had collaborated with Kokeilimo were also asked if they would like to co-operate with Soteekki in the future. Soteekki is Satakunta University of Applied sciences' service center of social and health care, where

companies and individuals can order welfare services, which are produced by the students under the supervision of the lecturers.

Participation in the survey was completely voluntary. Names of the companies were received from the above-mentioned organizations providing living lab/testbed services. Their e-mail addresses were collected online from companies' web pages. The survey was created using Google forms and contained both open-ended and close-ended questions. The close-end questions were multiple-choice questions and dichotomous questions, which according to Bhaskaran and LeClaire (2010) are questions that can be answered with a yes-or-no answer. The advantage of close-end questions is that they are easy to answer, the different answer options are right there, and they do not require as much contemplating from the respondent as an open-ended question, thus it made for a quick survey. And finally, the data from multiple-choice questions were easy to analyze.

These multiple-choice questions enabled the respondent to compare responses and select one. The researcher ensured that the respondent was given a comprehensive selection of responses. Descriptive statistics were used to analyze the quantitative data and conventional content analysis to analyze the qualitative data, i.e., the data from the open-ended questions. Since there were not that many answers to the open-ended questions, the coding was done manually.

When analyzing the content with conventional content analysis, there are according to Hsieh and Shannon (2005) no set categories to sort the data in, instead the data is read several times to get a feeling of the whole data set. After that, the data is read word for word to call attention to key thoughts or concepts to derive codes, which is followed by the researcher expressing first impressions and thoughts of the data. This makes labels of codes stand out in the text that represents more than one key thought. These are sorted into categories based on how they are related to each other, and the categories are used to sort the codes into clusters.

The data from the first open-ended questions were read. After that, text that indicated knowledge of living lab/testbed activities and indicated positive/negative associations to living labs/testbeds was highlighted. This text was in turn reduced to keywords, which were seen as preliminary codes. After deciding upon preliminary codes, the rest

of the answers were read with these in mind, and the data was sorted under these codes. The data under each code was revised, and these codes were then presented in the results section together with the answers to the close-ended questions which were presented as frequencies.

5.2 Ethical concerns

The research was conducted according to the responsible conduct of research, and this was observed in every step of the process, in collecting the data, presenting, and evaluating the results of the research. This process should not violate the target group of the research, the scientific community, or the responsible conduct of research according to Vilkka (2007). The research followed the standards that are approved by the scientific community, which are integrity, meticulousness, and accuracy when conducting research.

When conducting quantitative research, harm can be caused to the target group, if the collection of data causes uncomfortableness, or inconvenience, for example, if the test goes on for too long. These kinds of harms can be kept to a minimum, by keeping the promises made to the object of research and his or her organization. If, for example, the time it takes to fill in the questionnaire is supposed to take approximately 10 minutes, but because of technical difficulties, takes one hour to fill in, harm has been caused to the subject and his or her organization.

To guarantee the anonymity of the participants the questionnaires in this study were anonymous, and no information that could identify the companies or the participants was collected, nor any personal data. All the collected data were discarded after analysis.

6 RESULTS

6.1 Respondent's background and perceptions of living labs/testbeds

A link to the survey was sent via e-mail to 41 health technology companies operating in the Satakunta area, 12 of which had previously collaborated with Kokeilimo. Of these 41 companies, 18 answered the survey, which results in a response rate of 44 %. Of the 12 companies that previously had collaborated with Kokeilimo, 6 answered the questionnaire. On the first question, 12 of the respondents stated that they had co-operated with a living lab or testbed provider.

The second question was open-ended and regarded what kind of associations the respondents had to living labs/testbeds. Some of the respondents mentioned development and product development (f5) some (f4) mentioned testing. Only a few (f2) mentioned co-operation with customers. Some of the respondents (f4) had a positive perception of living labs/testbeds, one considered them to be important platforms for collaborations between businesses and schools, and another for finding out customer needs.

Six of the respondents' associations had a negative tone and included perceptions that the living labs/testbeds provide the platform, but then the company is left alone to do the work themselves, and that the collaboration with living labs/testbeds was one-sided. Another respondent questioned whether it was the function of the technology or the outcome that was evaluated. One respondent chose to not answer the question at all.

6.2 Previous knowledge of and information about living labs/testbeds

When asked to mention something they know about living labs/testbeds in the third question, quite a few (f9) of the respondents already have some knowledge of what living labs/testbeds are and how they work. Only three of the respondents did not know anything, the others mentioned that living labs/testbeds facilitate testing and product

development and that they are open networks. Five of the respondents mentioned that living labs/testbeds involve co-operation with other stakeholders, two of these mentioned clients/users. Some (f2) of the respondents had used the services of living labs/testbeds and one had also been involved in creating a testbed. This was an open-ended question.

One of the respondents mentioned that the collaboration felt complicated and time-consuming. One mentioned that it was difficult to find a suitable living lab/testbed for the companies' purposes. He/she claimed that it was difficult to know what each living lab/testbed had specialized in, and did they have a different value when references were considered. The same respondent also mentioned difficulties in finding information what is the cost of testing. Even though most of the respondents know something about living labs/testbeds, no one listed all the features of a living lab. Three of the respondents chose to not answer this question.

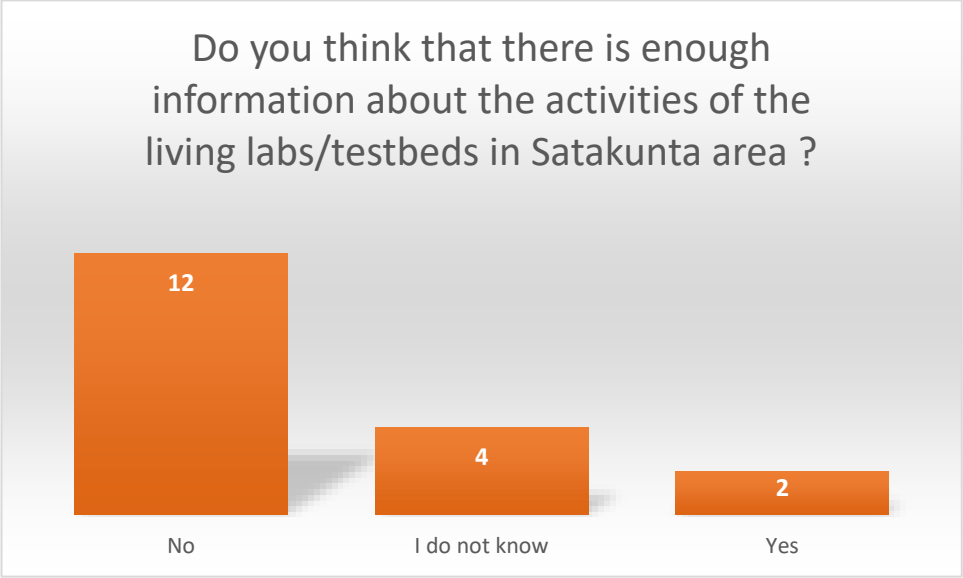

Figure 2. Respondents' view of available information about living labs/testbeds.

As can be seen from figure 2. most of the respondents (f12) did not feel that there is enough information about living labs/testbeds in Satakunta, and four did not know whether there is enough information. Only two of the respondents felt that there is enough information available.

Further on, on the question in which way the respondents wished to receive information about living lab/testbed activities, eleven of the respondents wanted to receive information through an electronic newsletter and seven through the Satakunta Testbeds web page. Other popular options were LinkedIn and phone, through which six of the respondents wished to receive information. One of the respondents wished to receive information through an advertisement in the paper or through a business advisor or business development company. This was a multi-response question, where the participants could choose more than one option. The respondents also had their suggestions and wanted to receive information by being personally contacted, in an arranged meeting, via e-mail, or through DigiSote operations.

6.3 The needs and wishes of the companies in product development

The companies' needs and wishes were inquired about by asking what kind of help with product development living labs/testbeds could provide the respondents in the company they currently work for. This was also a multi-response question, which allowed the respondents to choose as many of the options as they liked. As can be seen from figure 3. many (f12) of the respondents, felt that they could use some help with the acquisition of references related to user experiences and with finding out the usability of the product. Almost as many (f11) wanted help with getting scientific references for their products.

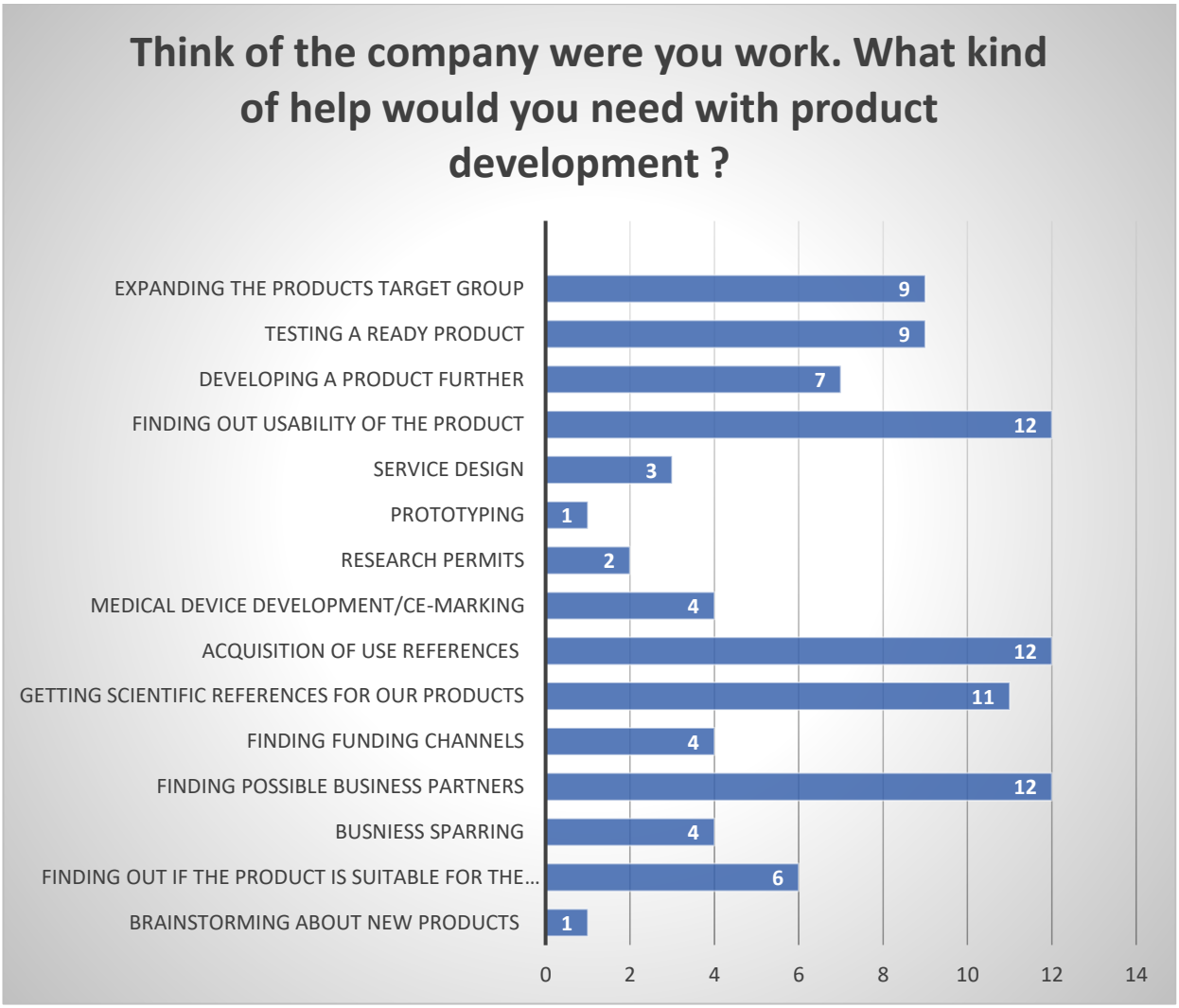

Figure 3. Help needed with product development

Testing a ready product and expanding the product's target group was something that nine of the respondents thought they could use some help with. Seven of the respondents would like to have help with further developing a product and six with finding out if the product is suitable for the social- and healthcare sector design. Business sparring, medical device development, and CE-marking as well as finding funding channels interested four of the respondents. The least popular options were service design, of which three respondents were interested in getting help and research permits, of which only 2 were interested and brainstorming about new products, and prototyping, in which only 1 respondent was interested. (Figure 3).

Figure 4. Feedback from expert groups

When asking which experts/user groups the respondents would be most interested in getting feedback from and doing tests with, Figure 4 describes how all but one of the respondents wanted the social- and healthcare personnel's feedback and wanted to test products in collaboration with them. Other popular groups were patients/customers, fourteen of the respondents wanted their opinion. Associations and organizations such as Reumaliitto and pensioners associations were interesting partners according to six of the respondents and five were interested in co-operating with second grade and university of applied sciences students. Only one of the respondents wanted to co-operate with business experts. This was also a multi-response question, which allowed the respondents to choose as many of the options as they liked.

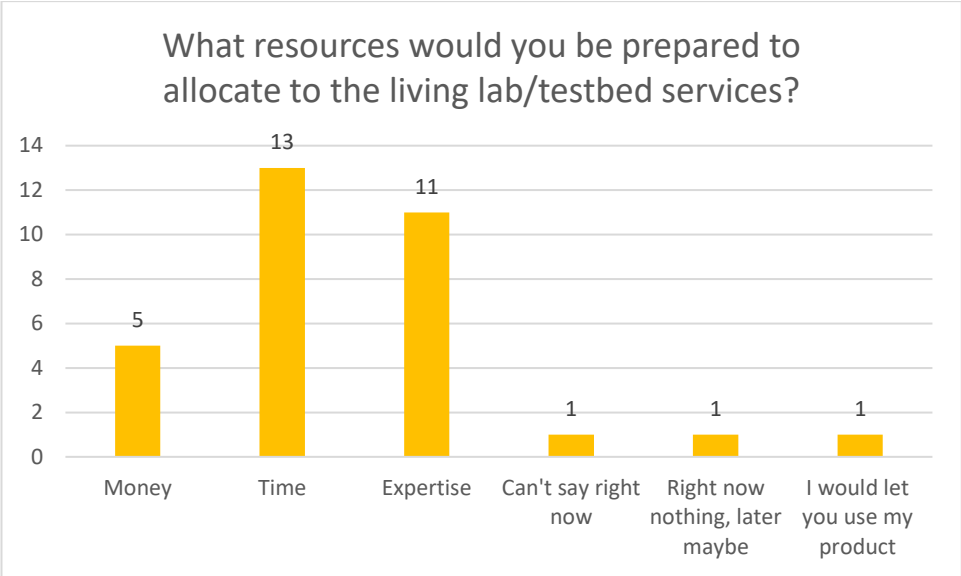

Figure 5. Resources that could be allocated by the companies for collaboration.

Companies were also inquired about what resources they would be prepared to allocate to living labs/testbeds with another multi-response question. From Figure 5 can be seen that thirteen of the respondents were willing to allocate their time and eleven their expertise. Only five of the respondents were prepared to allocate money, one of the respondents was not prepared to allocate anything at the time, in the future, and one choose the option "I'm not sure yet." One of the respondents chose their alternative and said that they would like to provide their product for use. One of the respondents chose not to answer the question at all.

6.4 Preferred testing environments

The next question concerned testing environments, more specifically what kind of real-life environment the respondents would be interested in testing their products. Like most of the previous questions, this was a multi-response question as well. Popular options were an assisted living facility (f14), a hospital (f11), and a home (f10). A school/educational institution interested three of the respondents and only one was interested in testing their products in a non-institutional social- and healthcare environment. No one was interested in testing in kindergartens. One of the respondents

chose to add an option to their one, they were interested in testing their products on the Internet.

When asking about what kind of simulated environment the participants would prefer to test their products, the option “home-like” environment raised the interest of twelve respondents. In second place came hospital wards, with nine respondents’ interest. Only two of the respondents were interested in testing their products in an ambulance and one in an operation room. Where there was an option to add your suggestion, one of the respondents suggested elderly homes, dispensaries, and home care as places that could be interesting. Another suggested that a health center would be a good option for testing products. Homes for the disabled and outpatient clinics were interesting according to two of the respondents. One was interested in testing their products in reception and one of the respondents thought that any of the alternatives were suitable when testing remote healthcare services. One of the respondents suggested a gym or rehabilitation facility. This was also a multi-response question.

The last question of the survey, also a multi-response question, concerning other environments where the respondents wanted to test their products. As many as thirteen of the respondents were interested in testing their products as part of a thesis, and ten of the respondents could imagine testing products as part of the studies students perform at school. Only two of the respondents wanted to test products in a laboratory environment. One of the respondents wanted to give an example of an environment that would be interesting and mentioned that they wanted to test their product in a real environment and explore the usage of the product as part of a thesis, and one mentioned that they wanted to test their product in a real-life setting arranged by rehabilitation students.

6.5 Additional questions for Kokeilimo users

For the respondents that had used the services of Kokeilimo, the survey contained some additional questions. The first question was which of Kokeilimos services they had used in the past. Four of the respondents’ products had been on display at Kokeilimo and product introduction services and for one of the respondents,

Kokeilimo had performed a user survey and testing. This was a multi-response question and only four of the respondents chose to answer this. The next question regarding which of these services they found most useful received only three answers, and two could not tell which was most useful, since they had not received any feedback from Kokeilimo. One of the respondents felt that the displaying of their products at Kokeilimo had been most useful.

Also, the next question received only three answers, and one of the three was blank. This was the question regarding the reason for not using the above-mentioned services. One of the respondents felt that the entrepreneur had to use a lot of his/her own time and called for developing better services for entrepreneurs. The other respondent was not quite sure which of the services they had used, other than that the product was on display on the Kokeilimos webpage.

On the question of which method they would be more interested in when testing products in Kokeilimo, all five respondents who chose to answer this question agreed. They wanted to test their products with a suitable target group that fits the purpose and receives a written summary of the feedback. The target group and the scope of the testing would be chosen based on a joint conversation. The experts of Kokeilimo would supervise the testing of the products, assemble the feedback received and compose a written summary (and if desired, a development proposal) for the company. All the respondents' preferred the previous alternative over the alternative where Kokeilimo only provides the space and the expert from the company supervises the product testing, assembles the feedback, and composes a summary. On the question on which other services they would like to purchase from Kokeilimo, there was only one blank answer and one answer that wished the cost of the services should be made clear.

When asked what other kind of co-operation they would like to do with SAMK and Kokeilimo, four of the respondents chose to answer the question. The respondents wanted to get feedback about the use of their product. One of the respondents also wished that the piloting of the products would lead to a direct dialogue between their company and the customer. One wished for product placement in local/nearby hospitals. If they would continue to work with Kokeilimo, three of the respondents

wanted to be contacted when needed, two wanted to be contacted regularly once a month and two wanted to be contacted when user feedback had been collected.

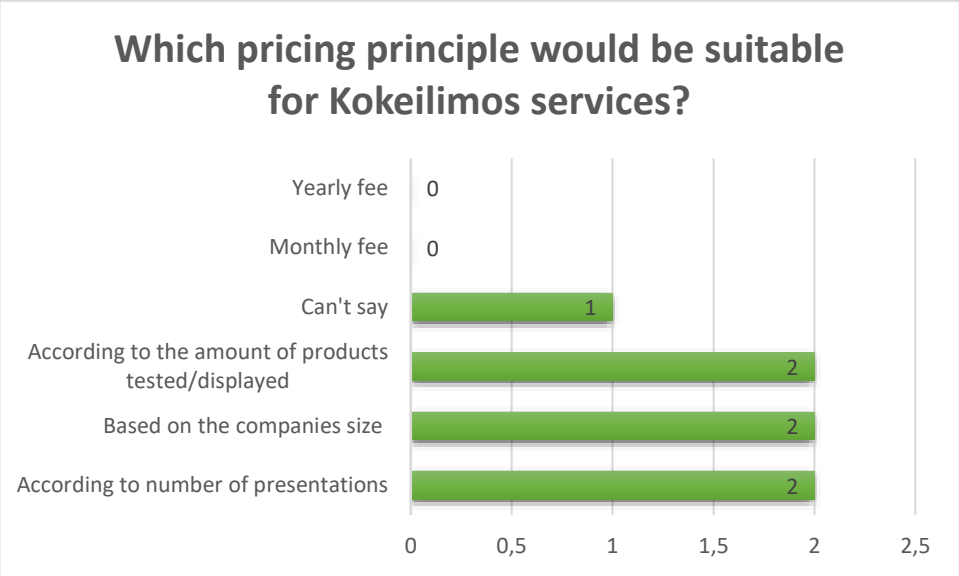

Figure 6. Preferred pricing principle for Kokeilimo

When asked about which pricing principle they thought were suitable for Kokeilimos services, as we can see in figure 6, two thought that pricing according to several presentations, two thought that pricing based on the company's size would be suitable, and two thought that pricing according to the amount products tested/displayed. One of the respondents did not have an opinion. None of the respondents favored a monthly or yearly fee.

The last question regarded if the respondents would be interested in the other environments for testing and other experiments that SAMK provides. Two of the respondents were interested in the technologies laboratory, and two in Soteekki's services. One of the respondents was interested in the nursing simulation space.

7 DISCUSSION

7.1 Limited knowledge of living lab/testbed activities

ENOLL (European network of Living Labs) defines living labs 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. The collaboration takes place in a real-life environment, where end-users participate as equivalent partners with other participants, to develop products or services for themselves and other end users."

Analyzing the respondents' answers regarding their previous knowledge showed that some of the respondents had some knowledge about the operations of living labs/testbeds and listed one or two of living labs/testbeds characteristics, for instance, testing, developing, and piloting. Closest to listing all the features came the respondent, who, when inquired about his/her thoughts or associations to living labs/testbeds, stated that:

"An opportunity to develop products with a real customer. Suitable for the development phase of the service/product. Product development in a living lab requires a company's resources. Companies hope that they will get a chance to sell their products to actors in the social- and healthcare sector, which is not the purpose of a living lab. Serves local companies, when they have the knowledge and the person might have graduated from the local university of applied sciences."

Even though most of the respondents had co-operated with a living lab/testbed, they did still not have much knowledge about their operations. For example, only a few mentioned the collaboration with users, and only one the co-creation. Some of the respondents even had a completely wrong picture of living labs/testbeds, when saying that in a living lab/testbed, a location is provided, but everything else is left to the company to figure out.

One of the respondents who mentioned this had not co-operated with a living lab/testbed, so it could be he/she simply did not have enough knowledge of living lab/testbed activities. The other that mentioned this had co-operated with a living lab/testbed but referred to it as a testbed, which indicates that the test environment was more like a testbed, where the ready product was tested without the involvement of the testbed's personnel, and with the end-users only as testers, not as co-operators. Even so, a testbed should provide users that can give feedback.

Because the terms are used interchangeably in Finland, it might have been the reason why so few of the respondents mentioned co-creation with users. They did not know that in a living lab, co-creation with clients/patients is one of the features, which is not the case in a testbed.

Since most of the respondents thought that there is not enough information about living labs/testbeds in the Satakunta area, it does not come as a surprise that their knowledge about the concept is limited. This also complies with Yli-Seppälä's (2012) findings when exploring the perception and experiences of SMEs general managers and researchers with living labs, the companies did not have enough information about living labs and the possibilities they bring. Santonen (2020) also claims that SMEs and startups do not have enough information about living lab services and suggests that a larger investment in marketing and sales would increase companies' awareness of living lab services.

When asked about how they would like to get their information, most of the respondents wanted to get their information through an electronic newsletter, from Satakunta testbeds-webpage or on LinkedIn, which of course matches the fact that we live in a digital world nowadays. No one wanted to receive the information through social media like Facebook or Instagram, which could be because the respondents do not see these platforms as business platforms but more as leisure time platforms.

7.2 Support in the product development process

In the product development process, the matter that companies felt they could need the most help with was getting scientific references and using references for their product as well as an evaluation of the usability of the product. Finding possible business partners, expanding the product's target group, and testing a ready product were also things that the companies thought they could use some help with.

The fact that the help is most needed at the end of the product development process, matches Haukipuro et al. (2019) findings were the finalists in the FICHe e-health accelerator especially benefitted from using a living lab approach in the final part of making the product ready for the market. Seppänen et al. (2020) describe how Elsa testbed provides a testing/validation service, where the companies get to test their products in a real environment, like for instance a hospital ward, and get the feedback from professionals in the healthcare sector. It seems like many of the respondents were interested in this part of the product development phase. Lepik and Krigul (2021) also found that one of the main features SMEs wished for help with was product testing, when studying the expectations and needs of health sector SMEs in Estonia from living labs in an international context. It is possible that the respondents had a ready product in mind when answering the survey, and therefore had needs more towards the end of the product development process.

Many of the respondents expressed the need to find possible business partners through a living lab, and Haukipuro et al. (2019) also found that one of the main benefits of using the living lab approach for the finalists in the FICHe e-health accelerator was that they got help finding the right business models and target groups and expanded their networks which resulted in new partnerships. So, it seems that the wish to find possible business partners through a living lab is possible. This, in combination with the fact that the needs of the companies were towards the end of the product development process, implies that SMEs do not have a problem producing ideas for products but financing those ideas.

When creating the question regarding what kind of support the company needs in the product development process, the MDR was used as a reference. It came as a surprise that the respondents were not more interested in validation according to medical regulation and CE-marking, as medical device development has certain requirements and laws that must be considered for. In Lepik and Krigul's (2021) study, the companies' especially felt the need for help with validation according to medical regulations and CE-marking. It is possible that none of the respondents currently were planning to bring a medical device to the market and therefore did not see the need for this service.

7.3 Experts and users for feedback and testing

All but one respondent wanted to co-operate with social- and healthcare personnel, get their feedback, and test products in collaboration with them. When reviewing synthesizing health-related studies that used the living labs approach, Kim et al. (2020) found that 80 % of the studies had healthcare professionals and the private sector involved. All studies applied user engagement. This corresponds with Vertanen's findings (2019) when looking at what kind of skills companies wished for from Elsa testbed's working group, where the companies valued social- and healthcare sector expertise.

When studying the effects of the living lab tests on the product development of technology companies Holappa (2018) found that according to the technology companies, the greatest benefit of living lab collaboration was, amongst others, the authentic users and environments, the opportunity to work with social- and healthcare personnel in an authentic environment and the possibilities to find new targets groups.

Even though other interesting partners were patients, very few of the respondents mentioned patients/clients as stakeholders. This could be because of the lack of knowledge about the activities of living labs/testbeds, where patients/clients as stakeholders are an important part. It could also be because the needs of the companies

were at the end of the product development cycle, where the product is almost ready and requires testing, not co-creation.

7.4 Companies' resources

Most of the companies in this study were ready to allocate personnel resources and working time to the living labs. This also came up in Yli-Seppälä's (2012) study when exploring the perception and experiences of SMEs general managers and researchers with living labs, where the interviewed managers stated that if they co-operated with a living lab, they would allocate enough personnel to participate in the living lab activities, and the found it self-evident that the co-operation would require their personnel's participation.

Only a few of the companies in this study were prepared to allocate money, and Santonen (2020) concludes that the main revenue stream for the living lab is public project grants and fixed funding. The lack of information about living lab/testbed services might make it hard to see the value of their services. Santonen (2020) found that living labs show an interest in targeting preventive care service providers as partners, which suggests that living labs attempt to variate the sources of their revenue by showing more interest in a private sector-driven customer base. As an example, Niemelä and Sachinopoulou (2019) describe how Oulu Welfare lab has productized its services and offers a price list for companies.

7.5 Environments for testing

The companies were, according to the respondents, most interested in testing their products in the real-life environment of a home or a hospital, or an assisted living facility. For the simulated environment, the answers were similar, home or hospital wards were considered most interesting. For other places, schools seemed like a place the companies are interested in, they wanted to test their products as part of a thesis, or as part of the students' other studies. In Junghee et al.'s (2020) literature review, many of the studies were conducted in hospitals, homes, and assisted living facilities

or similar facilities, and the living lab approach was used in most of the studies to examine older people and populations' health problems.

The fact that most of the respondents wanted to test their products in a hospital, home, or assisted living facility, and with healthcare personnel or patients could be since it is where they imagine their products being used. It could also be because so far, these have been the environments healthcare living labs/testbeds have operated in the healthcare sector.

7.6 Kokeilimo

Since so few of the companies that had collaborated with Kokeilimo chose to answer the survey, it is hard to draw any conclusions. At least we know that all the companies who answered would prefer to have the experts of Kokeilimo carry out the testing and compose a written summary of the feedback, and that and at the companies only wanted to be a part of the selection of the testers. Based on the results it seems like the companies want to be in contact with Kokeilimo quite often, this should be considered when planning resources for Kokeilimo in the future. It is important to keep the companies and clients in the loop about how the testing is going. It would be beneficial for Kokeilimo to provide information about its services and pricing principles. The pricing principles should consider the companies' size, as well as the number of products tested, or the number of times tested.

7.7 Validity and reliability

Vilkka (2007) states that validity and reliability together form the trustworthiness of a quantitative study. When estimating a study's trustworthiness, amongst other things we need to consider how well the sample represents the population, that the sample is large enough to measure, and the instruments' ability to measure the research subject comprehensively. The survey should be done at a time convenient for the target group.

The population in this study is health and welfare technology SMEs operating or located in the Satakunta area, and the sample was the companies who have collaborated or planned to collaborate with living lab/testbed environments in Satakunta University of Applied Sciences, Prizztech Oy, Sataedu or WinNova. The sample represented the target group well but was quite small. It is therefore not possible to generalize the results to all the SMEs in Finland operating in the health and welfare technology area. In this study, a questionnaire was the best way to reach this sample, as entrepreneurs are usually quite busy, and might not have had time for interviews. A questionnaire provided them the opportunity to answer the question at a time that suited them.

Further, Vilkka (2007) points out that the content of the questions should be as concrete as possible and that there should be enough questions and answer options regarding the matter studied, and that questions regarding opinions and attitudes are distinct entities. Testing and correcting the questionnaire before sending it can also increase its trustworthiness. Comments from other people, for instance, thesis supervisors and colleagues, can also increase the trustworthiness of the study and prevent errors. In this study, the questions in the survey were discussed with the thesis supervisor and the person in charge of Kokeilimo and revised according to their feedback. The questionnaire was not tested beforehand, which in retrospect could have been done. But the questions in the survey are very concrete and easy to comprehend, and the questionnaire contained a covering letter, with general information about living labs/testbeds.

Heikkilä (2014) also points out that the answer rate needs to be high enough. Vilkka (2007) adds that the method used for analysis should make it possible to extract significant information about the matter that is studied and that the entire process should be done fair and meticulously. To increase the response rate, two follow-up e-mail was sent to the respondents, according to Deutskens et al. (2004) this is the most effective way of increasing the response rate. The questionnaire and the follow-up e-mails were sent out at the beginning of the workweek to increase the response rate. The response rate of the survey was 44 %, which can be considered acceptable but not great. It might be that the companies' representatives that were not interested in co-operating with living labs/testbeds chose not to answer this questionnaire. Also, those

that did not know anything about living lab/testbed activities could have chosen not to answer.

As the survey produced mainly numerical data, how it is displayed is the clearest and most efficient way of displaying it. The answers to the open-ended questions were analyzed using content analysis. When a respondent chose to not answer a question, this was also clearly accounted for.

8 CONCLUSION

8.1 Recommendations

Kielo-Viljamaa (2021) mapped testbeds in Finland and found that there is not enough information about Finland's testbeds activities, and the result of this survey leads us to believe that the health and welfare technology companies operating in the Satakunta area are not that familiar with the living lab/testbed concept either. So, for starters, living labs/testbeds must provide more information to the companies about the services they provide.

As previously described, the terms living lab and testbed are used interchangeably in Finland, but internationally there is a difference. It would be a good idea to separate these terms in the future so that testbeds are providing testing services, where users are expressing their opinions on an almost ready product, and living labs are providing the opportunity to co-create with users. This would make it clearer for the companies what services the living labs/testbeds provide and easier to choose the most suitable one for their needs.

Since an electronic newsletter, Satakunta Testbed activities' webpage and LinkedIn were the top choices for receiving information about living lab/testbed activities, living labs, and testbeds in the Satakunta area should start there. As was mentioned by Kielo-Viljamaa (2021), and by one of our respondents, the pricing of the services should be visible. At least a starting price or a price for a standard package could be visible and then of course there should be an alternative to tailor the services to the companies' individual needs. More information about what living labs/testbeds provide would naturally increase the knowledge of their activities as well, for instance by a briefing.

In this survey, the companies needs were towards the end of the product development process. With more information available, it could be possible that companies would consider using living lab/testbed services at the beginning of product development. These could be services such as brainstorming, service design, and prototyping. This would allow for the other co-creators to be a part of the process from the beginning

and might, in some cases, save the company valuable time, as the testing process could be shorter and there would not be necessary to make as many corrections to the product/service.

It would also be a good idea to market other solutions than only testing their products with healthcare personnel more actively to companies, for instance, show what possibilities a University of Applied Sciences could provide, with students as co-creators with freshly attained knowledge. Involving the product ideation, testing, and validation in a student's thesis process is also an opportunity that could be promoted more.

Few of the companies are prepared to allocate money to the co-operation with a living lab/testbed. This is most likely because they do not yet see the real value of participating in a living lab/testbed. This inevitability loops back to the fact that there is not enough information available about living lab/testbed activities in the Satakunta area. This also means that there is no information about the benefits of co-operating with a living lab/testbed. By making information available and bringing forward the benefits of co-operation, it would be possible to charge the companies for the valuable feedback and advice that living lab/testbed activities could provide.

8.2 Future studies

Since the sample in this study was quite small, it cannot be considered representative of all healthcare and welfare technology companies in Finland. Therefore, it would be of interest to broaden the study to other cities and even nationally, and use the results found in this study as a basis for further studies. This way the different national living labs/testbeds could better tailor their services to fit the needs of the companies in their areas.

It would also be interesting to collect feedback from companies that have participated in living lab/testbed activities, and then take a qualitative approach to it and interview some of the companies to find out how they experienced the process. To make it easier for companies and living labs/testbeds to acquire testers, it could also be beneficial to

find out what could motivate users to participate in living lab/testbed settings, especially healthcare personnel.

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APPENDIX 1. QUESTIONNAIRE

Kyselylomake

Käsitteitä living lab ja testbed käytetään Suomessa usein samanaikaisesti. Living lab/testbed toiminta on tutkimus- kehitys- ja innovaatiotoimintaa, jossa loppukäyttäjät, sote-alan ammattilaiset, yritykset, elinkeinoyhtiöt, yliopistot/ammattikorkeakoulut ja julkiset hyvinvointialan organisaatiot tekevät yhteistyötä tavoitellen innovaatiota. Living labeissa ja testbedeissä suunnitellaan, kehitetään ja testataan eri tuotekehitysvaiheissa olevia tuotteita, palveluita ja ohjelmistoja yhdessä ammattilaisten ja loppukäyttäjien kanssa.

Living lab/testbed toiminnassa julkiset hyvinvointialan organisaatiot tai oppilaitokset tarjoavat yrityksille toimintaympäristönsä ja resurssejaan yrityksen tuotekehityksen tueksi. Yritykset hyötyvät tästä toiminnasta monella eri tavalla. Hyötyjä ovat muun muassa tuotteen, palvelun tai ohjelmiston soveltumisen varmistaminen sotea-alalle, uusien ominaisuuksien/käytettävyyden kehittäminen tuotteelle ammattilaisten tai loppukäyttäjien palautteen perusteella, lisääntynyt tunnettuus tuotteelle ja vaikuttavuuteen liittyvien referenssien saaminen.

Tarkoituksemme on selvittää living lab/ testbed toiminnan tunnettuutta Satakunnan alueella ja miten yritykset toivovat saavansa tietoa tästä toiminnasta sekä minkälaisista living lab/testbed palveluista yritykset hyötyisivät eniten.
Alla löydätte kysymyksiä joihin toivon teidän vastauksen. Valitse parhaiten sopiva vaihtoehto

1. Oletteko tehnyt yhteistyötä living lab/testbed toimijan kanssa?
Kyllä/Ei

2. Millaisia mielikuvia testbed/living lab toiminta herättää?

3. Mainitse jotain mitä tiedät testbed/living lab toiminnasta?

4. Onko tarpeeksi tietoa saatavilla Satakunnan testbed/living lab toiminnasta?
Kyllä
Ei
En tiedä

5. Miten haluaisit saada tietoa testbed/living lab toiminnasta? Voit valita useamman vaihtoehdon.
Lehtimainos
Puhelinsoitto
Elinkeinoyhtiöiltä/yrittäjyysneuvojilta
Sähköinen uutiskirje
Instagram
Facebook
LinkedIN
Blogikirjoitus
Muu some-kanava, mikä?

6. Ajattele yritystä missä työskentelet. Minkälaista apua tarvitsisitte tuotekehityksessä?
Tarvitsemme apua:

Uuden tuotteen ideointiin
Sen selvittämisessä, sopiiko tuotteemme/palvelumme ylipäätänsä sote alalle
Liiketoiminnan sparraukseen
Mahdollisten yhteistyökumppaneiden selvittämiseen
Rahoituskanavien selvittämiseen
Tieteellisten referenssien hankkimiseen
Käyttöreferenssien hankkimiseen
Lääkintälaitekehitykseen/ CE merkinnän hankkimiseen
Tutkimuslupien hankkimiseen
Prototypointiin
Palvelumuotoiluun
Käytettävyyden/käyttäjälähtöisyyden arviointiin
Tuotteen jatkokehitykseen
Valmiin tuotteen testaukseen
Tuotteen kohderyhmän laajentamiseen esim. toiselle erikoisalalle

7. Minkä asiantuntija/käyttäjäryhmän koette kiinnostavimmaksi mahdollisen palautteen ja testauksen kannalta?

Potilaat, asiakkaat
2. asteen ja ammattikorkeakoulun opiskelijat
Seurat ja yhdistykset, kuten reumayhdistys, eläkeläiset, omaishoitajat
Sote-alan ammattilaiset
Liiketoiminnan asiantuntijat
joku muu, mikä_____

8. Oletteko valmiit resurssoimaan living lab/testbed palveluun?

Rahaa
Työaikaa
Asiantuntijuutta

9. Missä aidossa kliinisessä ympäristössä haluaisitte testata tuotteenne?

Koti
Sairaala
Palveluasuminen
Päiväkoti
Koulu/oppilaitos
Muu, mikä?

10. Missä simulaatio ympäristössä haluaisitte testata tuotteenne?

Kodinomainen tila
Leikkaussali
Vuodeosasto

Ambulanssi
Muu, mikä?

11. Missä muussa ympäristössä olisitte kiinnostuneet testata tuotteenne ?

Laboratorio ympäristössä, jossa käytössä mittauslaitteita ja valmiita kaupallisia tuotteita joita voi verrata oma tuotteeseen
Osana opiskelijoiden opintoja
Osana opinnäytetyötä
Muu, mikä

Kysymyksiä Kokeilimon palveluiden käyttäneille

1. Mitä Kokeilimon palveluita olette käyttäneet?
Meillä on ollut näytteilleasettajapaikka ja tuotteiden esittelypalvelu _____ kuukautta
Olemme mahdollistaneet laitteemme kotivuokrauksen Kyllä/ei
Laitettamme on vuokrattu kotiin Kyllä /ei
Kokeilimo on toteuttanut meille käyttäjätutkimuksen/testauksen Kyllä/ei
Olemme itse toteuttaneet käyttäjätutkimuksen/-testauksen Kokeilimon tiloissa Kyllä/ei

2. Minkä yllämainituista palveluista olette kokeneet hyödyllisimmäksi, miksi
_____
_____

3. Jos ette ole käyttänyt yllämainittuja palveluita vielä, mistä syystä?
_____
_____

4. Jos haluaisitte testata tuotetta Kokeilimossa, kumpi menetelmä olisi kiinnostavampi?

Testaus tarkoitukseen sopivalla kohderyhmällä ja kirjallinen kooste saadusta palautteesta Tuotetestaukseen valitaan yhteisen keskustelun perusteella kohderyhmä ja testauksen laajuus. Kokeilimon asiantuntija valvoo tuotetestauksen, kokoaa saadun palautteen ja laatii kirjallisen koosteen (ja haluttaessa kehitysehdotuksen) yritykselle.

Testaus valitulla kohderyhmällä, yrityksen asiantuntija osallistuu testaukseen ja kerää palautteen Kokeilimo järjestää tilat ja yhdessä sovitun testausryhmän tuotetestausta varten. Yrityksen asiantuntija valvoo tuotetestauksen, kokoaa saadun palautteen sekä laatii yhteenvedon.

5. Millaisia muita palveluita haluaisitte ostaa Kokeilimosta?
_____
_____

6. Millaista muuta yhteistyötä haluaisitte tehdä Kokeilimon ja SAMKin kanssa?
_____

_____

7. Tulevaisuudessa, jos jatkatte yhteistyötä Kokeilimon kanssa haluaisin, että minuun ollaan yhteydessä

säännöllisesti, kuinka usein_____
kun käyttäjäpalautetta kertyy
kun tulee uusia palveluita
tarpeen mukaan

8. Mikä olisi mielestänne sopivin hinnoitteluperiaate

Vuosihinnoittelu
Kuukausihinnoittelu
Hinnoittelu esittelykertojen mukaan
Hinnoittelu yrityksen koon perusteella
Hinnoittelu testattavien/esiteltävien tuotteiden määrän perusteella
Joku muu, mikä?

9. Oletteko kiinnostunut myös SAMKin muista kokeilua ja testausta mahdollistavista toimintaympäristöistä?

Hoitotyön simulaatiotilat
Tekniikan laboratoriot
Soteekki – sairaanhoitaja-, sosionomi- ja fysioterapeuttiopiskelijat tuottavat laadukkaita ja edullisia sosiaali- ja terveysalan palveluja