New players in an immature market:

Living labs & test centres
for health and welfare innovation

Analysis of living labs’ working methods and examination of the company’s goals for services.

March 2015
1. Main points and conclusion

2. Introduction
   2.1. What is living labs?
   2.2. About the analysis

3. Living labs: Innovation with people in the centre
   3.1. From design to implementation
   3.2. Main phases of the innovation process
   3.3. Activities and methods in the innovation process
       3.3.1. Starting point: The strategy
       3.3.2. The definition phase
       3.3.3. The design phase
       3.3.4. The verification phase
       3.3.5. The realisation phase

4. Participants, tasks and types of living labs
   4.1. Participants
   4.2. Tasks and skills
   4.3. Five types of living labs

5. What will living labs do?: Health and welfare are changing
   5.1. Demographics drive innovation
   5.2. Megatrends will transform both the health and welfare sectors


7. Survey: The companies’ goals for living labs
   7.1. Living labs can help an underdeveloped market on the way
   7.2. The companies would like to meet the municipalities in living labs
       7.2.1. High demand for knowledge on municipal needs
       7.2.2. High demand for knowledge on implementation
       7.2.3. Also interest in knowledge on sales
       7.2.4. General overview: The companies lack knowledge on problems they can solve

8. Perspective: Room for improvement
   8.1. Cross-cooperation
   8.2. Specialisation
   8.3. Skill development
   8.4. Promotion of exports and Denmark as a global development and testing centre

10. Source references
1. MAIN POINTS AND CONCLUSION

Amongst municipalities, hospitals and businesses, interest in "living labs" and test centres is increasing. A variety of different living labs have sprung up and more are on the way. However, the objectives of the individual labs are different and the concept covers very different types of institutions, test centres and offers to companies. This analysis sheds light on the phenomenon, opening the black box and presenting the various components that are part of living labs - specifically the living labs dealing with health and welfare issues.

Copenhagen Living Lab and Public Intelligence has, on behalf of Væksthus Copenhagen, studied the practices of Danish living labs and organisations conducting living lab-like activities on health and welfare issues and on this basis has developed a model which describes their mode of operation.

What is a living lab?

A living lab sets the framework and structures for user-centred innovation in cooperation between private companies and the public sector. This is done by facilitating processes that extend from needs analysis and concept development to implementation and sales.

Basically, one can distinguish between two different types of living labs:

1. **Design labs**, which bring new solutions to the world.
2. **Implementation labs**, which bring new solutions into people’s lives.

The two types of living labs cover two of the innovation process’ four main phases, as illustrated in the model below. The model should be read as a clock starting from the top.

**Design labs** partially address the *definition* of the problem which is the subject of development and also the specific *design* of the first new solutions. Together, the two phases lead to a 'proof of concept' and a functional prototype. Design labs span the first six hours of "the clock face."

**Implementation labs** verify new solutions’ functionality and impact, so they can then be sold and implemented and therefore *realised* by moving into people’s lives, where they create higher quality of life and new practices. Implementation labs span the last six hours of "the clock face."

Together, the four main phases - definition, design, verification and realisation - are an innovation process in which human needs are translated into relevant solutions whose value is verified and then realised through the solution being *applied* in practice.
Each of the four main phases contains a series of activities that help to define the character of a living lab.

The 10 main activities include: Understanding needs, idea development and conceptualisation, technical design, business modelling, usage and experiential development, technical testing, functional testing, quantitative economic analysis, investment and procurement and final implementation.

**Danish living labs are distributed unevenly in the innovation process**

This analysis shows that the vast majority of living labs in Denmark are engaged in activities falling within the last half of the innovation process – verification and realisation. Therefore, significant gains may be achieved by establishing living labs which are increasingly concerned with identifying and defining the needs new welfare technology must cover.

In the innovation process, the nature of the activities a living lab can contribute to strengthening falls into three main categories: Organising, learning and design. The different tasks require different skills, and a living lab’s size and organisation will therefore depend on how many tasks it wants to perform. Since the vast majority of living labs are relatively small organisations, it is crucial to consider their own core skills and services and ensure an effective and productive interaction with external actors who can handle the other tasks in the innovation process. It is important to keep in mind that cooperation in living labs involves citizens, public participants and private companies. In practice, operating a living lab requires a more differentiated picture of the various participants, including: Public business owners, commercial business owners, solution developers, employees (users) and ordinary people in the roles of patients, families and citizens.
Living labs in the healthcare sector are divided into four categories of options

As mentioned, this analysis focuses on living labs dealing with health and welfare issues. Therefore, they operate in a dynamic field where demographics and budgetary constraints form the background for development.

From a commercial perspective, health and welfare markets are generally considered from a demand perspective (healthy vs. sick) and a customer perspective (professional welfare and health stakeholders vs. private consumers). By extension, the challenges and overall driving forces which characterise the health and welfare sector provide space for living labs with different areas of focus:

- Nursing and care
- Treatment (in hospitals)
- Developing solutions across social and health fields
- Development of solutions for the private consumption market for health care services and products

Living Labs will, depending on their position, have different business and financial challenges and opportunities, but a sustainable living lab requires a sustainable business model and the business model affects the lab’s self-understanding, incentives and relations with the outside world. The vast majority of living labs are publicly funded, but this does not necessarily mean that it is entirely clear from day to day who is a customer and who is a supplier. Here there is generally a need for greater clarity on consumers and business models for living lab services.

The companies want clear knowledge on problems they can solve

Almost all living labs and test centres see private companies as key players and as requirements for them to meet their goals. But looking at what businesses are searching for in a living lab, there is currently a mismatch between the services the various living labs offer and the services the companies consider most important. Specifically, there is a shortage of living labs which systematically, continuously and at the right level of abstraction, define and communicate the needs of citizens, employees and the public sector which companies live by finding solutions for.
The pressure to find new solutions and to become better at innovation – using living labs – applies to the entire public sector and the welfare sector as a whole.

This analysis provides a conceptual framework which can assist public and private stakeholders in their considerations regarding the establishment and operation of living labs. Including an understanding of what companies want in relation to health and welfare innovation, which in the context of the analysis primarily means innovation in medical care and elder care.

2.1 What are living labs?

Living Labs are frameworks and structures for innovation processes which put people in the centre. This is a wide range, which at the one end includes exhibition environments, demonstration apartments and other physical arenas for demonstration of welfare technology and at the other end, systematic investigations of people’s everyday lives with the purpose of setting the direction for development of new solutions.

Living labs are innovation environments which bring together public and private stakeholders with interest in the development of new solutions in a real life context, which makes it possible to involve users in different stages of the innovation process – for example as informants, co-developers and testers.

Living labs as innovation environments can provide:

- overview of new solutions
- insight into human experiences and behaviour
- opportunity to engage people in co-creation
- early feedback on ideas
- a starting point for the development of new solutions, which from the beginning are defined by the tasks and challenges that people want to solve – as opposed to development, which is based on technologies and products.

Living Labs are organisations which support the meeting between technology and people with the purpose of creating new value and contributing to measurement of the effects of the meeting, both qualitatively and quantitatively. In the concept “living lab,” the word “living” represents human life as it unfolds under varying circumstances and in different situations, while the word “lab” in the broadest sense represents the testing of various technologies which can form the basis for new solutions.
2.2 About the analysis

The analysis was conducted on the basis of qualitative interviews with 10 Living Labs and similar organisations covering key variations of the phenomenon. In the interviews, the following is asked:

- Which parts of the development process contribute to the lab? Is there a particular focus on, for example, products, services or processes? Which methods and tools are used in the lab for what?
- How is the public-private interaction organised? Who are the customers, users and suppliers? Who contributes what to the value offered?
- What is the real life context offered in the lab? Which users are given access to the lab? Under what conditions? How is user data collected, stored and transmitted?

15 qualitative interviews have also been conducted with different types of companies which have been involved in living labs or lab-like activities. Questions are asked about what requirements companies have in order to test and develop products together with the public sector. The qualitative interviews are supplemented by a questionnaire sent to all companies in the WelfareTech cluster. The analysis also draws on the knowledge and experience of the phenomenon gathered by Copenhagen Living Lab and Public Intelligence in the past 10 years.

Living Labs are a diverse phenomenon, and the following describes different types of labs and their respective working methods. It is based on five main perspectives:

- **Process**: High requirements are placed on the innovation process in terms of framework and activities?
- **Participants**: Who participates in living labs and the various labs which grow from them?
- **Skills**: What is the character of the innovation tasks and what are the requirements for the solution developers’ skills?
- **Position**: Where are the various living labs located in the health and welfare ecology? And what meaning does this position have for their market focus?
- **Business**: How does the development business interconnect?
Including:

- What should the public sector / Living Labs / test centres offer in order to be interesting collaborators for Danish and foreign companies?
- Under what terms will cooperation take place? Which business models appeal to companies?
- How should Living Labs be organised and function and what should they offer? What skills, tools, documentation, etc. do companies expect?

The analysis is divided as follows:

Section 3 introduces the basic premise of living labs: Innovation with people in the centre. Section 4 examines the participants involved in living labs and their respective roles and interests. Section 5 describes the special circumstances which apply to innovation in the health and welfare sector.

Section 6 outlines how the various living labs work commercially. Section 7 deals with corporate demand for living lab services.

Along the way, this is supplemented with a series of short cases which illustrate various living labs and different welfare technologies and their background in the innovation process.

In conclusion, there are a number of development perspectives which point towards further development of the value of Denmark’s living labs.
For thousands of years, innovation in health has been driven by scientific research and technological development with the purpose of healing and fighting disease. This "medical" development tradition sees the person as a mechanism that breaks and therefore needs repair.

Longer life expectancy, new knowledge and new research has led to the emergence of a new and more holistic innovation approach where the person's entire life is a starting point for innovation. Amongst the new domains of knowledge which are now involved in innovation are anthropology, design and research on the interaction between humans and computers.

Since the mid-2000s, Denmark has tried to make this particular innovation approach into a position of strength under the heading "user-driven innovation". Elsewhere, this type of innovation is known as "design thinking" (see source reference 4). A concept which the chairman of the US design firm IDEO, Tim Brown, made famous with the words:

"Design thinking is a human-centered approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success"
3.1 From design to implementation

The innovation process raises fundamental issues which fall into two categories.

One category of questions deals with the needs of a particular group of people in specific contexts and how these needs can be addressed with new or improved solutions. It could be questions like: Which essential needs hide behind a problem’s immediate appearance? Which technological possibilities can be translated into principles, concepts and prototypes for solutions?

The second category of questions concerns the circumstances which can move a newly developed solution towards use. It could be questions like: Can a solution be paid for and produced within an budget which matches the value the solution creates? Can the new solution be integrated into customers’ processes and organisations or are new structures required? The two sets of activities which are implemented to find answers to the innovation process’ key questions are fundamentally different in a number of parameters. One can generally talk about two different methods of working, reflected in two different types of living labs:

- **Definition and design activities**, which collectively comprise a design lab
- **Testing and implementation activities**, which collectively comprise an implementation lab
A design lab assists public and private stakeholders in identifying needs and developing new solutions in response to these needs.

An implementation lab assists public and private participants in verifying the value of new solutions through qualitative and quantitative tests and selecting and implementing new solutions.

Although the innovation process can be said to include all activities from concept to marketing, the activities of the two halves of the process require different structures and support – i.e. two distinct methods of working.

The fundamental difference in purpose and working methods for design labs and implementation labs means that a living lab, in order to create maximum value, must define itself and answer the question: Which living lab are we?
3.2 Main phases of the innovation process

Each of the two working methods can be subdivided into a series of phases and activities. Overall, the process is broken down into four overlapping phases to be perceived as different ‘compartments’ rather than steps in a linear process:

- **Definition**
- **Design**
- **Verification**
- **Realisation.**

*The definition phase* includes the identification of a problem or an opportunity. Here the focus is on requirements or early ideas.

*The design phase* consists of conceptualisation, ideas and technology and practical design of a new solution. The outcome is a functional prototype which can be designed in innumerable ways along the way: A simple paper sketch, a physical mock-up, a service pilot, a functional application, etc.. The point is to create a tangible first version of a new solution which makes it possible to produce the solution and make it into an object for (limited) reproduction and testing.

*The verification phase* subjects the developed prototype to various qualitative and quantitative tests which can establish the solution’s value.

*The realisation phase* goes back down the road, moving solutions into people’s lives. This is about decision-making processes and marketing, which leads to buying and selling, as well as organisation and implementation activities.

3.3 Activities and methods in the innovation process

It can be beneficial to be inspired by the principles of medical research (see box) if you want to understand and demonstrate useful processes for innovation activities within the broader field of “health and welfare” – particularly when it comes to living labs.

To some extent, the innovation activities follow the exact same pattern, but the development tradition within the broader health and welfare sectors is not nearly as long, the roles are not nearly as well-established and the knowledge domain is social rather than scientific.
How medicine is developed

First step: Preparing for human testing

The development of medicines goes through five phases before being tested on humans for the first time.

1) Where is the need?
If you want to create a new drug, you must first know that there is a disease which is not being treated well enough.
Only if doctors are seeking new medication or if the developers can see the opportunity to make a much better version of an existing one does the process proceed.

2) Why do people get sick?
When pursuing an idea of a new medication, it is important to find out why people are getting sick. Finding a so-called “target” is perhaps the part into which the most time and money is invested. Here, the most errors are made, but it is also here that hypotheses can be developed for how a disease can be understood and treated in a person.

3) How does illness effect people?
When researchers have found a cause of the disease, the next step is to find a drug which affects this ‘target’. The compound is usually one out of thousands of possible substances which affect the connections between nerves, damage molecules or do anything else which regulates the functions of the body, depending on where the target is located.
In practice, researchers clone the gene of their target and expose it to up to 500,000 different substances and contexts to see different reactions. Another possibility is to make the target into a crystal and study the molecules using X-ray and 3D technology and thus see the effects of different substances.

4) When does the substance reach its goal?
A few select substances move on and are tested in animals. They can cause an abundance of problems. The substance may need to be absorbed into the bloodstream in pill form and a high concentration may stay in the brain. The substance - which at this point is only a single molecule - must not be toxic or affect other molecules and thus cause side effects. Finally, the substance could be in the body for a long time, so the patient should only take one pill instead of 10 a day.

5) Does the substance work?
It is one thing to pick out the substance, but does it also go where it should and affect the target as it should?
Scientists measure in different ways where the molecule goes and how it works, for example, through blood tests or PET scans.
In the real world, the five points will rarely go in order like beads on a necklace. Instead, a substance will typically move up and down through the points several times before it is ready for the next step in development: Studies in humans.
Second step: Human trials

It is a giant leap to transfer experiences from animal and cell experiments to humans. The substance has already been studied every which way for 3-5 years, but to ensure that it can really be used on people, it should pass through an additional four crucial test phases:

Phase 1
Duration: 1-1½ years / Testers: 50-200 healthy people / Chance for final success: 12%
The selected drug is tested in a low dose on healthy people who are paid to spend up to a month at a special hospital while they are tested, have their heart rate measured, etc.
The dose will be slowly increased to a level which has been shown to be effective in animal studies, while scientists keep an eye out for possible side effects.

Phase 2
Duration: 2-3 years / Testers: 200-600 healthy people / Chance for final success: 21%
Phase 2 is a direct extension of phase 1 and has the purpose of observing the effects of the substance over time, taking blood samples and interviewing the volunteer patients who are in hospital wards or in some cases meet up with their general practitioners. The experiments take place in many different places, because hundreds of patients are involved and because it is necessary to map the effect of the medicine on different people.

Phase 3
Duration: 3-4 years / Testers: 2,000-4,000 healthy people / Chance for final success: 58%
The last testing phase before a new medicine is registered and sent to market. The requirements are stricter as to who may participate in the trials. Each volunteer patient must only have the disease in question. This removes the risk of other diseases interfering with the body so that researchers get a more precise picture of how the medicine works in a human body.

At the same time, pharmaceutical companies have to look more closely at the budget. For example, if the medicine lowers the patient’s blood sugar, what does it cost to bring it up again and do the side effects of the medicine mean increased expenses for visits to the doctor?
The studies have to give the authorities an impression of what the treatment costs, so it has to be figured out whether it is more worthwhile than other treatments that might already be known.

On top of this, the test subjects are tested against a group of patients receiving an inactive placebo and another group receiving another existing treatment.

Phase 4
Duration: months or years / Chance for final success: 89%
When a drug has made it through Phase 3 – and possibly a final round of turbulence – all information is collected and sent to the health authorities in Europe, the US and Japan, amongst others.
If the drug is approved, the company starts a negotiation with the authorities on what the medicine will cost and then the drug is finally approved and ready to go to market. It may still happen that the medicine also goes through a final analysis, for example, because the company behind it wants to document the effects further or the authorities require more tests.
Following in the tradition of medical research, the innovation process’ four main phases are broken down into 10 main activities, as illustrated in the figure below. The activities involve various meetings between users and technology which can be supported by living labs.

In order to give an additional layer to the understanding of the activities in a living lab, they can be divided by whether they relate to organisation, learning or design:

**Organisation activities:**

- Design and scope of the specific development task
- Clarification of questions needing answers
- Establishment of methods for finding answers
- Definition of user variables for delivering data
- Recruitment of users
- Planning and design of interaction
- Facilitation of interaction between users and developers
Learning activities:
- Collection of data from users
- Data processing
- Pattern recognition
- Analyses
- Knowledge collection

Design activities:
- Use of data for further specification of the solution
- Formulation of value proposition
- Design of prototypes
- Development of business model

You might rightly ask when the innovation process is finished and a living labs’ role has been played. The immediate response is that the process is finished when there has been a large-scale implementation of a new solution and there are conditions for a realisation of the value obtained from it.

3.3.1 Starting point The strategy

Prior to the involvement of a living lab, there are typically strategic considerations by both public and private participants.

The strategic scope for the public part could at one end of the spectrum be a desire to create an overview of available solutions in order to make a decision on a new purchase and at the other end, an ambition to contribute to development of entirely new answers to important problems. The time frame for execution of a strategy will be correspondingly different.

The strategic impetus has great importance for the lab activities in demand.

In the strategy "New paths to health and care," Copenhagen Municipality has defined four welfare technology tracks heading towards 2025. The tracks set the direction and become concrete in annual investment catalogues: "It occurs through the health and care committee choosing which challenges and target groups welfare technology must find solutions to, the quality of the solutions and the scope of the investments."
If the public development ambition is primarily driven by a desire for short-term savings, solutions are demanded which can reduce operating costs. An overview of existing solutions is sought which can be implemented relatively risk-free within a short time frame.

If, on the other hand, this is about a long-term strategy, it is often directed at creating a development dynamic which can eventually yield multiple solutions and potentially also contribute to the local economic development.

The public development strategies will typically have a focus on the quality of the offerings to citizens and/or an economic savings. For example, the municipality’s strategies are typically driven by proactive ambitions, budget challenges or centrally formulated goals and requirements, such as the agreement between the government and KL on savings of DKK 500 million. The public strategies can also be rooted in economic development goals, but in reality these will be secondary and subject to welfare task considerations.

For a private company, the strategic impetus prior to involvement in a living lab will be business considerations: Does the company possess resources which can contribute to growth and competitiveness if they are invested in solving a given problem? There can be a major difference in business strategies, depending on whether a company is new to the market or comes from the traditional health and welfare industries such as medical technology and devices.

The greater the focus a strategy has on identifying new needs and new customer segments, the more relevant living labs will be as a business development service.

### Strategy

<table>
<thead>
<tr>
<th>Short-term</th>
<th>Long-term</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image_url" alt="Strategy Diagram" /></td>
<td></td>
</tr>
</tbody>
</table>

### Customer/user

<table>
<thead>
<tr>
<th>NEW</th>
<th>KNOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image_url" alt="Customer Diagram" /></td>
<td></td>
</tr>
</tbody>
</table>

### Needs

<table>
<thead>
<tr>
<th>KNOWN</th>
<th>NEW</th>
</tr>
</thead>
</table>
Randers Regional Hospital has since 2008 sent staff and patients to Midt Labs “living lab” for development of the next generation of hospital beds. Almost a decade went by from when Director of Nursing Karin Valbaek got the idea for “The Future’s Intelligent Hospital Bed” in 2006 until the first “Opus 5” hospital bed was ready for delivery by the end of 2014. The development project is thus an example of endurance, patience and innovation over the long term.

Based on the initial idea for the bed, the Central Denmark Region and the Regional Hospital in Randers invited a number of suppliers to a public-private collaboration in 2008 to develop “The Future’s Intelligent Hospital Bed.” The goal was to create a bed which challenges and optimises workflows in and around care. The key issues which have driven the development cooperation have been about the patient’s safety, comfort and self-reliance, about the staff’s safety, working environment and workflows and about new opportunities in connection with infrastructure, IT and communication. Altogether, large and complex questions which cannot be answered with a quick turnaround.

The company KR from Hadsten chose to participate in the project because of the opportunity to develop close cooperation with the users. With flexible development and production facilities designed for small prototype series, it has been possible to make improvements quickly and efficiently informed by the ongoing user testing.

![KR logo](http://www.krbed.dk/)

Figure 1. "The new intelligent hospital has become more than a place where the patient is located. It has become an integral part of the clinical work related to care, mobilisation and relocation services." (MD KR Klaus Brock) http://www.krbed.dk/hospa
3.3.2 The definition phase

When the strategic desire for innovation and development is clear, the development process starts itself – and here is the definition phase, the first step. The phase has two main activities: Understanding needs and idea development.

**Understanding needs** depends on the innovation project’s strategic focus and impetus, but typically deals with obtaining knowledge about:

I. The citizens’ daily lives and the tasks they seek to solve in specific situations (for example, taking a bath) and under specific conditions (for example, specific disabilities, chronic illness, etc). The needs can be explicit requests for the known options, but can also be unrecognised and unspoken.

II. The employees’ professional practice – the tasks they solve and the challenges they have in connection with them.

III. The economic circumstances connected to the area as such and to private consumption and professional practice: How many, how often, at what price, etc.

It is a key task to define needs at a level which is both sufficiently abstract in order to be open to innovation and sufficiently tangible in order to form a basis for concrete ideas and sketches.

Living labs can contribute organisationally to the process by creating contact with citizens and employees and in terms of learning by disseminating area-specific knowledge economic indicators and can facilitate workshops, meetings, etc.

**Idea development** is typically handled by solution developers. They may have needs for potential users (those who face a problem daily) to contribute to brainstorming or provide early feedback on ideas.

Living labs can contribute organisationally by making contact and making agreements with users and by facilitating coaching meets, idea development workshops, etc. Correspondingly, a living lab can assist in terms of learning, for example, by organising feedback on early ideas.

The early phases of an innovation process can be structured using tools such as, for example, a People Value Canvas (see source reference 12). It is a framework consisting of nine building blocks which constitutes the input needed to define a new value proposition. They form the basis for a holistic concept and assist in capturing the interdependence between the different dimensions in a user-centric value proposition.

The central idea in the framework is that a product or a service can offer added value if it meets the users’ needs and reflects their motivations. On the one hand, the framework helps by structuring the users’ needs and preferences in relation to the context and effect. On the other hand, it describes how a proposed new solution meets the user-driven criteria.
3.3.3. Design phase

The design phase begins when the early definition phase has provided a general conceptual understanding of what a solution could be. It includes activities related to the specific design of a solution and is controlled by the type of solution. This will typically involve the specification of functionality, experiences, technical components, service design, user interfaces, costs, business model, etc. Depending on the solution and the solution developers’ approach to clarifying the task, a variety of prototypes of the future solution will be prepared.

For the wide health and welfare sectors, in addition to responding to functional requirements on support of work process, solutions must also be able to support people directly in their tasks, for example, to live ‘a healthy life’ or get on their feet after a period of illness. Designing a solution can be about the design of experiences and relationships and the formulation of solutions which motivate and support people in a particular behaviour, helping them to motivate themselves mentally and incorporate new habits.

The design phase is comprised, amongst other things, of a ‘technical’ part where company, designers and developers only have a limited need to involve users. However, there will typically be a need for a workshop where different versions of prototypes are presented with regards to getting feedback on the functionality, design, price, etc. Living labs can assist with the organisational task of getting in contact with users and making agreements on their participation in workshops, etc.
The commercial development of a solution will typically demand more specific knowledge of costs with regards to existing practice in relation to select citizens. How many units and how much time, for example, is required to solve a specific task for a certain group of citizens? How many of this type of citizen are there? How does purchasing work? What is emphasised in the selection of solutions? Etc.

Living labs can assist in this learning task by providing companies and developers access to anonymous information from public treatment, payment and financial systems.

There are also a number of tools (see source reference 2) developed for use in the design of business cases and similarly, a Business Model Canvas (see source reference 1) could be used to structure the development of business models.

A living lab can assist with dissemination of information on requirements which must be met so that the solution can be used by public customers and users in a certain area. For example, there may be requirements for the use of certain IT standards, legislation, health and safety standards, policy, etc.

In the final part of the design phase more detail-oriented feedback should be organised in user interfaces and interactions between users and the developed solution. There could also be a need for special testing facilities (usability labs), which could possibly be made available through living labs.

The road to a new memory system for medicine

Jesper K Thomsen owns the studio, Studio Jesper K Thomsen ApS. He works according to the motto “design with justification”. This means that if something new is to be developed and imagined, the project must solve a real problem. The problems the drug recall system solves came to the studio’s agenda when the OPI consortium LevVel contacted Jesper in 2012 and presented the difficulty which some people have taking the right medication at the right time. The ball was caught – and the launch of DoseSystem led to development of a mobile dispenser. DoseSystem ApS became an independent company in August 2013.

In 2013, the first part of the development was implemented in collaboration with Gentofte and Copenhagen Municipality. Citizens and employees gave feedback on the first version of “DoseCan – an intelligent dose dispenser solution” with regards to identifying functional and design suggestions for improvement, formed a basis for a business model (for municipalities and companies) and conceptualised a service design.

As the background was drafted, new versions were regularly presented to 40 municipalities to get their feedback. So it has been very much a draft process driven by users, which resulted in a product that matched citizens and staff – and could be delivered with regards to the target price. 15 municipalities borrowed and tested a prototype in the process. When the design was in place, investors entered the field, so production could be set in motion. In December 2014, the product was ready for a systematic test of the solution in Åbenrå Municipality. In February 2015, the product was ready for final operation and is already out in 10 municipalities in DK.

It may sound like a detour – but as Jesper says: “Even if the review on a car is really good, we would all want to take a test drive before buying a new car.”
3.3.4 The verification phase

In the verification phase, a solution is tested in order to determine the potential value for customers and users. This requires a version of the solution which can be tested in the form of either a finished product or a functional prototype. The nature of such a prototype will of course vary depending on the nature of the solution. For example, it could be a service design, manuals, a physical product or software with or without integration with existing systems. Verification activities must therefore be designed to reflect the specific solution.

The first part of the verification is typically a technical test, which is about ensuring that the solution can effectively function in the environment in which it is intended. There may be a need to ensure that solutions meet standards and labelling requirements. Living labs can assist in conducting these initial technical tests based on specific knowledge of the practical environment in which the solution will work.

The next phase of the verification is a qualitative functional test which can determine the value the solution creates for users. A test where a new solution is put into use for a small group of employees and citizens, it is intended to be able to clarify the specific value the solution gives them and simultaneously identify advantages and disadvantages. A qualitative test can also lead to the identification of new opportunities to use an advanced solution for creating value in ways which were not anticipated. Living labs can assist in this context by contacting users and making agreements for application testing. In this context, it must also be clarified what a test assumes about training, instruction, etc., when there might be a need, for example, to release employees for training and debriefing and a living lab can also help with this. A Living lab will also be able to assist in ensuring the systematic collection of data, which may require special training and instruction of employees and citizens and independent efforts with debriefings in workshops, meetings, etc.

In connection with implementation of sensor floors in Skovgården in Hillerød, the staff identified opportunities to use data from the floor to become aware of possible bladder inflammation in the residents (changes in number of visits to the toilet) in addition to the intended monitoring of falls and nighttime activities. (see source reference 6)
As part of a qualitative test of a new solution, there will also typically be a need to know the basis for being able to systematically assess how the new solution contributes to changing and creating value. Living labs may contribute to this learning task by conducting baseline measurements using questionnaires, time studies, extracts from financial systems, etc. With a basis in the obtained knowledge of how a new solution creates value, a qualitative analysis can finally provide input for the formulation of hypotheses about which quantitative effects - typically of an economic nature - a solution could provide.

The Danish Technological Institute has in this context developed a so-called Welfare Technology Assessment (VTV) which collects the various test dimensions in a common framework (see source reference 14).

Does it work in practice?

Vikærgården in Århus is – in addition to a site which offers temporary day rehabilitation – also a welfare technology experiment.

The management team is thus also divided into a nursing and a welfare technology branch with reference to both the local health authority and the Center for Freedom Technology.

In 2012, Vikærgården was converted to offer day rehabilitation to adults (18+) for periods of 1-6 weeks – with a particular focus on welfare technology opportunities. All 63 places are under renovation (in a comprehensive and phased construction project which exists alongside operation) to technologically update short-term housing with different content which covers a wide variety of the latest assistive technology in areas such as ceiling lifts, toilets with flush/dry function and pressure-sensitive floors. The first 10 homes were ready in 2013, and out of those, three are voice-operated.

The intention at the site is to match guests and rooms by needs – which may well mean that one chooses to move a citizen to another room during the course of that individual’s assessment and treatment process.
Along with the Alexandra Institute, Vikærgården and the Center for Freedom Technology develop the online evaluation tool EvaluateHealth (see source reference 7), which will promote and facilitate the continuous collection of experience with the technologies on site. The evaluation occurs about 3 weeks along in the process, where the therapist assesses whether the individual is comfortable with the technologies. The employees are primarily physiotherapists, occupational therapists, nurses and social and health care assistants and employees actively involved in the selection, dissemination and sharing of knowledge about the products.

The cooperation with companies is generally characterised by suppliers making their products/solutions available at favourable prices in order to get access to evaluation results. The management of technology suppliers is conducted in collaboration with Teknologi i Praksis, a social enterprise and supplier network supported by business region Aarhus and Care Ware. The large flow of citizens (500 per year) means that technologies get plenty of use, with no risk of them lying untouched.
However, verifying the economic effects requires larger quantitative tests. Solutions must be scaled across organisations and in order to create real evidence for a link between solution and specific effects, place requirements on, for example, randomised testing, where the new solution is used on one group of users and the traditional practice on another group. In the medical and medical technology domain, there is a long and regulated tradition of implementing such quantitative tests. A similar tradition has not yet been developed in the broad health and welfare domain. Here there are great opportunities for public living labs to be able to assist with both organisation and learning tasks.

3.3.5 The realisation phase

In order for the value of a solution to be able to be realised, it must be purchased and put into use on the market. In general, a distinction can be made between three different forms of value realisation:

1. Qualitative value realisation for end users (citizens or employees).
2. Cost savings, primarily in the form of lower public operating costs.
3. Contribution to growth and earnings for the company who developed the solution.

The value calculation should also factor in costs for implementation or market introduction, depending on perspective. In this context it is crucial that the public customer (or citizen) sees the purchase of a new solution as a cost or an investment. If the purchase is only perceived as the purpose of a new ‘model’ which replaces previous ‘models,’ the possible value contribution is reduced to a question of price. On the other hand, if the purchase and implementation of a new solution is regarded as an investment, the possible value contribution is increased and at the same time, the focus is on the assumption of value realisation (the implementation phase).

**Investment and purchasing**

The realisation phase’s first main tasks relate to investment and purchasing. This includes creating an overview of opportunities to achieve possible benefits and an assessment of the opportunities in relation to the specific situation.

Living labs can support this learning task by offering a qualified overview of the value-generating new solutions for specific challenges, for example, by arranging showrooms which can give both decision-makers and employees an updated overview of the existing technologies and a brief introduction to products. Such a qualified overview can be of great value: For example, the Swedish National Board of Health and Welfare’s Assistive Technology Data contains information about almost 60,000 assistive devices and more than 1,000 dealers. The many options mean that decision-makers often need for solutions to be put in context and for a selection of the most attractive one to occur.
Cross-inspiration – Joint centre for welfare technology in Aalborg, Brønderslev & Jammerbugt municipalities

The Center for Welfare Technology in Aalborg, along with the assistive device depot, is located in Aalborg Municipality and has the purpose of inspiring and showcasing the latest welfare technology for citizens and employees. The centre offers product overview and insight in the form of a showroom, a demonstration apartment and a classroom:

Showroom
Shows the latest welfare technology devices and IT solutions which can make everyday life easier and citizens more self-reliant.

The apartment
Consists of kitchen/living room, bedroom and bath where the welfare technology is shown in practice.

The classroom
Used by employees from both Aalborg Municipality and other municipalities for training in the latest technologies – for example, in lifting and moving. The premises can also be used for staff meetings, etc.
To the extent that new solutions are directed at citizens, there is a need for actual stores. As an example of this, Odense Municipality, in cooperation with the consulting firm Public Intelligence, has established a showroom "Technology for the apartment" with the explicit purpose of giving citizens information about solutions which can help them overcome various forms of disability. There are solutions which the citizens can purchase themselves instead of having to ask the municipality for help.

Part of the information which is typically demanded as a basis for decisions on purchasing new solutions relates to the economic effects. In this context, KL’s Center for Welfare Technology (see source reference 10) has produced a modified version of the "theory of change" (see source reference 15) under the heading "benefits tree." It can assist the municipalities with planning the events which are needed to create the changes and reap the qualitative and economic benefits which can be realised through proper implementation and use of welfare technologies. (see source reference 10)

The spread of the rehabilitative approach to elder care is one of the few innovations which have actually become scaled in a short time. The reason for the success is partly found in that it is a purely practical development and partly in that independent studies were conducted very early which documented solid economic savings.
Innovative purchasing

The public makes purchases of DKK 290 billion per year. Innovative purchasing represents an ambition to use part of this enormous public purchasing power to acquire new and innovative solutions which can both give the public more money and guarantee private suppliers the opportunity to develop and invest in new solutions for a paying customer. In its ideal form, innovative purchasing can thus at once lead to better welfare, greater efficiency and increased competitiveness.

Living labs can assist with innovative purchasing, since there is also a distinction between traditional innovative purchasing and pre-commercial purchasing. The purpose of the former is purchase of a nearly complete solution which allows for the implementation of a new practice. On the other hand, pre-commercial purchasing relates to purchase of services which lead to an understanding of new solutions which may only later be subject to supply and demand – just like when one is in an architecture competition, the selected suppliers are first asked to come up with a blueprint for a building and then an architect is chosen to realise the building.

Innovative purchasing should be seen as a contribution to a desired change. Innovative purchasing is not the goal in itself, as is the case in traditional purchasing, where the use of what is purchased is pre-defined. Innovative purchasing must contribute to realisation of a change in a welfare practice such that the new practice creates greater value. Value is defined in this context in relation to the three previously mentioned bottom lines: The quality for the citizens, the costs for the public and the economic growth of the involved companies.
The prerequisite for successful innovative purchasing is not just to identify a significant problem, but also an assessment of whether the chances to address the problem are increased by involving private suppliers. The dialogue with the market thus does not have the purpose of obtaining the lowest price, but identifying the partnership which holds the greatest opportunities for creating new value within a select and well-defined focus area.

With such understanding of the innovative purchasing, the concept relates to what private companies know as supply chain management or value-generating supplier cooperation. Supply chain management is management of integrated business processes across the supply chain which produces the products, services and information of value for the customers. Such a perspective combined with the citizen-centred approach to value means that innovative purchasing can include redesign of the business models which relate to welfare services and welfare production.

**Implementation**
The innovation process’ final phase deals with deployment of new solutions. For the overall goal of the health and welfare innovation to be realised, the new solutions must contribute to changing the way in which health and welfare is produced. The implementation task is thus not a trivial process of change, but must contribute to converted very large parts of the public sector.

Implementation can occur step by step by introducing new solutions which drive the conversion of processes and development of new skills and also more radically when alternatives arise to the public welfare production which undermine legitimacy and competitiveness.

Living labs can contribute to learning by assisting institutions and municipalities with the implementation of new solutions. This can occur long-term by incorporating knowledge of new solutions into basic education and also as concrete assistance in changing daily practice through workshops, courses and continuing education.
Various initiatives have already been brought into the world in the broad welfare area in this context. As part of the agreement between the government and the municipalities on savings of DKK 500 million through use of welfare technology, KL has produced a number of product-specific change tools within the areas of lifting and moving technology, wash toilets, better use of devices and robots. The institute for Everyday Technology (see source reference 9) offers short courses in which employees in elder care are introduced to new solutions in, for example, dementia as part of conversion of practice. And both SOSU North and SOSU Zealand have established centres for welfare technology as part of their training of SOSU aides and assistants.

In the health sector, there are training and simulation centres which can similarly contribute to education and training in new practice. CEKU (Simulation centre, Copenhagen University Hospital) (see source reference 3) offers, for example, individual and flexible education in certain clinical procedures. The instruction consists of active, hands-on training in virtual reality simulators, phantoms, animal organs, etc. All training concludes with a certification which can form the basis for further training in the clinic.

DIMS (the Danish Institute for Medical Simulation) (see source reference 5) offers similar training which can increase patient safety through medical simulations – i.e. roleplaying where some clinical situations are practiced before they become serious.
In order to understand the process around innovation in living labs, it is necessary to make it clear who does what – and where in the process different types of living labs can contribute.

4.1 Participants

Innovation and development of new solutions for the health and welfare sectors must be seen in light of the fact that the fields are dominated by the public sector. Innovation which leads to commercial growth therefore requires close cooperation between public parties and private suppliers. Living labs can act as a framework for this cooperation based on the participants’ common interest in understanding and accommodating identified needs within a specific domain and thus create value.

The value of an innovation cooperation for the public decision-makers will typically be a reduction in the working hours a specific task requires. For the private suppliers, the value consists of the sale of new solutions and thus growth and earnings. For both, there is the desire to create value for the employees and citizens which are the target group for a new solution.

4.2 Tasks and skills

Innovation in and of itself also requires combinations and involvement of various disciplines, since it is precisely in the meeting between various forms of knowledge that "the new" can emerge. IDEO Chair Tom Kelley describes in the book "Ten faces of innovation" a number of roles he sees as crucial for organisations’ ability to innovate. The roles fall into three main categories depending on whether they contribute to learning, organisation or design of new solutions. And they can be useful for looking closer in order to understand the various participants’ contribution to the innovation process.

**Learning**

People who accept the need to learn are humble enough to call their own worldview into question. Thus they are also open to new insights, which are of crucial significance, since both individuals and organisations have a constant need for new information in order to be able to expand their knowledge and grow. Openness to new knowledge and new perspectives can prevent organisations from becoming complacent, closed and believing that the world only consists of what they "know."
Organisation
Those familiar with organisation know the often illogical process which moves ideas forward. The organiser knows that timing, communication, budgets and resource allocation are vitally important and cannot simply be dismissed as "politics" or "bureaucracy." Organisation is a complex game of chess which is played to win.

Design
People and stakeholders who work with the design of new solutions use insight from learning and follow the organisational routes which have been mapped out for development of "the new." Their role is to develop value propositions, business models, functionality, experience and communication with customers and users.

A living lab can take on all three types of roles (learning, organisation and design), but the roles should be explicitly stated and reflected in the lab’s mix of skills.

4.3 Five types of living labs
As part of this analysis, 12 Danish living labs and living lab-like activities were surveyed. Their placement in relation to the various phases in the innovation process is shown in the figure on this page. The analysis shows a predominance of labs which deal with testing and realisation. Danish living labs seem to contribute to the initial definition of needs only to a limited extent.

The various living labs’ placement in the innovation process, which is set out in the analysis, do not necessarily correspond to the organisations’ self-understanding. Many labs perceive themselves as contributors to the entire innovation process. Nevertheless, their practice is predominantly aimed at specific parts of the process. And since the surveyed labs and test centres are primarily quite small organisations with one or two employees, this is not surprising and points back to the need to clearly define the roles a lab takes on.
In general, living labs and test centres can be divided into five types depending on function:

1. **The knowledge centre.**
The knowledge centre was brought into the world to identify and disseminate needs for new solutions. However, there was no special practice for this purpose amongst the surveyed living labs. This does not mean that needs for manufacturers of solutions have not been identified and disseminated from living labs. It just happens unsystematically and reactively through feedback on specific solutions or with a scope which is defined by existing practice.

It can be considered whether needs laboratories should be established which function independently of existing practice and possibly completely outside the organisations which deliver health and welfare services – in the same way as is the case in connection with evaluation of patient experience in the Capital Region of Denmark, for example.

2. **The development workshop**
The purpose of the development workshop is to contribute to the business, user and experience aspects of the new solutions which many of the interviewed labs have ambitions for. In these fields, there has been a professionalisation in recent years such that today – in the same way as with the engineering, IT and design fields – there are both trainings and companies which are specialised in, for example, experience design, service design or business development. Typically, the technical development is done with companies or specialised development workshops such as GTS institutes.

3. **The test centre**
In the test centre, new technologies which match strategically designated orientations are put through both qualitative and technical testing on a limited sample of citizens and/or employees. However, amongst the existing living labs, there is no systematic practice for collection of quantitative effects of new health and welfare solutions.
4. The store
This category of labs and offerings consists of a new type of health and welfare store which has the purpose of selling products and services directly to the citizens. There are stores which function in the same way as a specialised running or cycling business or a phone store, only with health and welfare products on the shelves.

The purpose of the store is to inspire and create the opportunity for citizens to actively purchase desired technology. The stores are typically staffed by professionals who, through demonstrations, present the technologies in a relevant citizen context. The staff might have their daily activities in municipal practice and would therefore be well-trained to see the citizens’ opportunities with the various technologies.

In each of the stores, there would be multiple elements from retail in the organisation. For example, they could think in traffic figures and continuously create various events and activities to entice visitors. The physical frameworks are also designed based on a desire to create an inspiring and energizing framework for a good dialogue on technology based on the citizens’ needs and opportunities. The stores are located with easy access for the citizens and often have both physical and digital entrances. Some also allow you to sign up for newsletters.

Although the citizens are in focus, the stores are also characterised by the various municipalities’ staff also stopping by to get inspiration.
5. The training course.

At the Training Course, it is about one thing: implementation. The discipline is hard and therefore there is a need for places where staff, citizens or technology manufacturers can practice.

The training courses can be used by the municipalities’ professional staff, where they can practice in practical environments before the respective technologies hit reality. The idea is to create a physical framework or arena where errors function as learning and do not create unnecessary concern and accidental anxiety amongst staff, leaders, citizens or stakeholders. The training courses can also be initiated by manufacturers who are interested in developing good models for implementation of their respective technologies.

The style and tone may vary, but the common basis is the idea is to create practical environments where reality can be simulated with citizens or phantoms and training can thus occur before a broader implementation of a new technology or practice.
Living labs in the health and welfare sectors operate in a field which is undergoing rapid development.

5.1 Demographics drive innovation

The area of elder care in particular has gotten increasing attention since the turn of the millennium as a result of demographic changes which are becoming increasingly obvious. Economic projections have made it clear that there are not enough “hands” or finances to accommodate the future needs and desires of the elderly if things are done based on the same model as before, nor can it meet the increased expectations of a new generation of the elderly. The recognition in recent years has turned into a discourse and forward-looking ambition which deals with transforming the challenges in the field into business opportunities for Danish companies.

Many other Western countries face the same challenges in the health and welfare sectors as a result of an aging population, more chronic patients, more lifestyle diseases and increased expectations for nursing and care. Therefore, the potential for export companies is enormous.

Denmark is a business cluster which is strong internationally, particularly in the pharmaceutical and medical device area. The positive development in the pharmaceutical and medical device area is partially due to the longstanding tradition of a strong public-private interaction around research and education, good frameworks for clinical research, a strong patent system and quick access to the market for new medicines.

However, Denmark also has good opportunities in other health and welfare sectors for creating growth and jobs. There is a substantial untapped business potential with assistive devices, service and operational solutions, consulting and healthcare IT, amongst other things. However, there are far fewer companies within these areas which have managed to translate skills developed in the Danish market for globally-oriented growth companies. In light of the many tasks regarding planning, delivery and monitoring of social and health services, this should be handled in the public sector and without involvement of private players. For the growth potential to be utilised within these business areas, there is a need for the companies to get a better opportunity to benefit from the knowledge and skills in the public sector for development of concrete new products and services which can also be sold on the international market.
It is the government’s vision for Denmark to be amongst the most attractive countries in the world for development, testing and production of health and welfare solutions based on strong research, rapid deployment of new innovative technology, good frameworks for public-private cooperation and a well-functioning, development-oriented domestic market. The health and care market is thus in growth and nationally, the requirement is greater efficiency.

**5.2 Megatrends will transform both the health and welfare sectors**

However, the health and welfare sectors are not just characterised by growth. This is also an area where the solutions are changing. Traditionally, innovation in the area has primarily been about the development of medicine and in addition, the professions have developed their practice through building their own education and research environments and have thus contributed to understanding of care, nursing, pedagogy, etc.

However, four horizontal megatrends can be expected to characterise future solutions:

1. **Digitalisation**
   Many processes are already digitalised and still more core processes will be able to be streamlined through digital support. But digitalisation can also open radically different, new solutions. So-called "disruptive innovations" may come to consist of what today is personal gadgets and so-called wearables – wearable technology – but which might tomorrow be personal monitoring and diagnostic tools which help the individual user live a healthy life.

2. **New knowledge domains**
   New knowledge and understanding of people from social and human sciences means that solutions and interventions have an increasing focus on the entire person (physical, mental and social). Issues such as experience, meaningfulness, motivation and relationships are important for healing, resource mobilisation (rehabilitation) and behaviour. Therefore, there is a growing focus on how the knowledge of this can help shape solutions.

3. **Private welfare stakeholders**
   Increasing costs in the health and welfare sectors mean that the boundaries between publicly financed benefits and services, private consumption and family care/civil self-organisation are shifting. This trend has particular significance for Denmark and the Scandinavian welfare model, where a very large part of the care and nursing has been provided by the welfare state for decades.
4. Rehabilitation
The greater life expectancy puts the focus on new types of solutions which can increase the number of healthy years of life. For the sake of both the individual’s quality of life and the social costs for health and care, it is important to turn increased life expectancy into as many years of life without illness and loss of function as possible. It puts the focus on solutions which can prevent and rehabilitate.

These four megatrends drive both a demand for new development tools – living labs – and place demands on these labs’ methods of working: For example, do they help pave the way for “disruptive innovations” – i.e. solutions which grow out of other industries or technologies than those which have traditionally been used? Are they open to new perspectives on human experience, meaning creation and behaviour? Are they able to involve knowledge from disciplines which have not traditionally been part of the medical paradigm? Do they create frameworks for development which open rethinking of the traditional division between public, private and civil players? And can they promote development of solutions which are not within the frameworks of publicly defined health and welfare, but which can affect demand through prevention?

The traditions in the health and welfare sectors are fundamentally different

It is a basic condition for all innovation and development that it is difficult to act and simultaneously reflect on how to act differently. Therefore, it is worth considering how living labs can help development ambitions by leaving the production sphere in order to consider alternative opportunities.

Innovation and development in the health and welfare sectors follow very different traditions. The medical development and innovation tradition goes back centuries and is based on a deeply ingrained and well-established role distribution connected to the overarching purpose: To combat illness.

The world as seen by actors is necessarily not the same as the world seen by observers. Observers are able to see alternatives – and to distinguish among them. But actors can see alternatives only in the moment of reflection, of observing, of not acting (the awareness of an alternative would be paralyzing).

Niklas Luhmann
Conversely, the development and innovation tradition in the broad welfare areas which address the results of people aging is far less well-established. The simple reason is that humanity has only started to live really long over the past 100 years. Therefore, neither role distribution nor purpose is clear in this broad welfare area – except that it is about “taking care of old people.” What does this mean?

Similarly, the complexity in the development areas in the medical field and the broad welfare area are different. Slightly caricatured, the (Western) medical domain is characterised by scientific, research-based innovation, while nursing and care is driven by social structures.

The most famous Greek physician, Hippocrates, worked around 400 BC in both Greece and Asia Minor, but is believed to have had his main work on the island of Kos. Hippocrates and his students produced a collection, since called the Corpus Hippocraticum, which contains writings on anatomy, descriptions of a number of diseases, examination techniques and considerations on the course of the disease (prognoses) based on careful clinical observations. As treatment, Hippocrates recommended that one should seek to support nature’s healing powers. Hippocrates formulated the still valid basis for medical ethics in the Hippocratic oath.

www.denstoredanske.dk/
Innovation is not a business in itself, but a business development activity. Living labs therefore represent costs for both companies and public players. These costs are included in the total innovation investment, cf. the figure below.

The vast majority of living labs are publicly financed either by being integrated in a public organisation or through government grants via, for example, research funding. However, many living labs consider how they can create more robust business models where the services are paid for by those who demand them. But who are the actual buyers of the services the different types of living labs can deliver?

The business models for public living labs are often complex, because they were brought into the world to satisfy multiple purposes: Better services, greater efficiency, political positioning and business support. However, following the above division of living labs into knowledge centres, development workshops, test centres, training courses and stores, the customers can be identified as follows:
**The knowledge** centre delivers the first services to municipalities and hospitals, which the centre can help by creating an overview of what is and is not known: For example, what are the latest developments and what significant problems have not been solved? The knowledge centre also offers private companies an understanding of unsolved needs which they can profit from solving. It applies to both the public and private buyers of the knowledge centre’s service that this is about an investment in creating conditions for new solutions. The costs are not necessarily high – but on the other hand, there is a long road to a sale or future savings.

**The development workshop** is typically a company domain. This is where the companies invest their own forces or pay for specialists who can assist with designing future solutions. Along the way, there may be a need to involve users in the form of employees or citizens. Living labs can organise access to these users. This currently often occurs without payment, because the relevant public stakeholders have a vested interest in the development of new solutions. Conversely, this means that it can be difficult for private labs to professionalise the type of services in question, as is known from, for example, the communication and marketing industry’s sale of focus groups and panel services.

**The test centre’s** services are demanded by both private “sellers” and public “purchasers.” The public purchasers want to know if it is likely that specific solutions (typically products) could lead to better quality and lower costs. The private sellers similarly want to find arguments which can lead to a first sale. Longer quantitative studies of effects of solutions are primarily demanded by public decision-makers and perhaps by researchers.

**The store** offers services to both public and private stakeholders who get the opportunity to form an overview and prepare employees for a new practice. For private companies, the store functions as a showroom and sales window for both public purchasers and private consumers, while the store for the private consumers functions much like any other store. It is the practice for private suppliers to make exhibition copies available for the store either free or on favourable terms and sales agreements have slowly begun to materialise between the store owners and suppliers.

The training courses’ customers are predominantly public organisations who want assistance implementing solutions.
Diakonissestiftelsen has always been a social pioneer and an outward-looking community which has gone out into the world, has identified needs and brought forth solutions in cooperation with others. It is in the diaconal culture to be innovative – and to look for the "holes in the cheese."

Diakonissestiftelsen is an independent institution and non-profit foundation which comprises a total of about 400 employees, 300 volunteers, spread across 5 centres/units for education, children and learning, church and culture, palliation and rehabilitation and psychiatry and elder care.

Dia-lab is co-funded by Diakonissestiftelsen and OPALL, not as a physical place, but as a method based on practical innovation for development with people in focus across all units, coordinated by a dedicated project leader.

Dia-Lab offers 3 services:
1) Coaching – on an idea or specific project/product
2) Testing – of the developed product in real environments
3) Product development/development pathways in cooperation with associated specialists

And has also been supplemented with a new focus on implementation.
Dia-Lab is a strategic investment in Diakonissestiftelsen. The intention is to offer private companies the knowledge found amongst employees and managers, students, volunteers and other citizens Diakonissestiftelsen represents and which can be made available by establishing a development process in the multifaceted practice environment.

The work with Dia-Lab has, in recent years, led to a recognition that this type of knowledge is a difficult sale – and that the consulting model, if it does not produce in the foreseeable future, will be turned over to a partnership organisation where Diakonissestiftelsen, in cooperation with companies, seeks new solutions for its own needs.
7. THE COMPANIES’ GOALS FOR LIVING LABS

As part of this analysis, it was surveyed how living labs and living lab-like services look from a business perspective. In addition to a series of interviews with the company managers from both small and large companies, a survey was conducted of the companies in Welfare Tech.

There is no doubt that companies are interested in living labs. The questions are thus: Where do the companies see the greatest value contribution in terms of their own business and business development? Which services are most interesting? And how great is the willingness to pay?

7.1 Living labs can help an immature market on the way

The market for welfare technology has – seen from the companies’ view – been characterised by a high degree of immaturity. The companies perceive that the municipalities have not been ready to enter into a systematic and structured product development and implementation process. The market has been characterised by many casual relations which have often resulted in pilot projects. And actually, the perception amongst the companies is that the municipalities have a much greater interest in creating pilot projects than in working at the base with implementation.

The consequence is that the companies never reach a product maturation where potential municipal buyers can form a basis for a standardised demand based on a development community’s experiences. The companies would thus spend many hours in a single municipality without ever realising a financial benefit, while the municipality corresponding puts many hours into a project without getting to a phase where the welfare technology can deliver its potential value in practice. A vicious cycle is created.

Living labs can help break the vicious cycle by offering a mature collaboration arena where suppliers and buyers can meet in a clear, systematic and open process where common terminology and mutual learning can go hand in hand. This applies all the way from development to implementation and can also provide an opportunity to create an early assessment of the economic potential of a new solution. In other words, you can spend your efforts on the products which best cover the municipal needs and thus create a mutually positive business cycle.

---

1 The analysis was conducted February 2015. 25 responses out of 125 possible - 20% response rate.
   In parallel the quantitative analysis was supplemented by a series of qualitative interviews.
Another significant feature of the market for welfare technology is the companies’ perception of the municipalities as a black box where they cannot figure out the relevant needs or understand the processes related to trading with the municipalities. This applies both to the initial, curious contact and the ongoing cooperation around a pilot project.

The market’s lack of maturity is not seen from the companies’ side as being the municipalities’ responsibility or fault, but leads to frustration about the lack of realisation of possible welfare technology benefits.

7.2 The companies would like to meet the municipalities in living labs

As shown above, the companies have a strong need to see, feel and understand the public players’ needs and they express a clear desire to develop products which solve future challenges. The benefits are clear – the greater the ability to affect real needs, the greater the commercial potential. At the same time, there is a belief that individual hospitals’ and municipalities’ needs are an expression of general, generic needs overall, which gives the companies further incentive to invest.

7.2.1: High demand for knowledge on municipal needs

Based on the survey (see p. 46), table 1 shows that the companies have a high interest in becoming familiar with public needs so that they can continuously get relevant input for product development.

However, the companies do not necessarily have the methodological knowledge required to translate a greater understanding of public needs into targeted product development. Living labs which want to work with development driven by municipal needs thus have a clear task to solve: There must be created a series of good and simple models and methods which can support the development process.

At the same time, there is a need to mature the municipality's ability to describe their own needs in a way which makes them easily understandable. Many companies point out that an early involvement, as early as the mapping of the municipal needs, will make them better able to match potential solutions with the needs.

All companies find it "important" or "very important" to get input for understanding public needs and a full 80 % find it "very important." However, the companies’ willingness to pay is hardly as large as their curiosity. Under half declare their willingness to pay for input and only 4 % are "greatly" prepared to pay.
7.2.2 High demand for knowledge on implementation

At the very end of the innovation process is the implementation of fully developed solutions. Here most municipalities and manufacturers recognise that one of the greatest barriers to the spread of welfare technology is the municipality’s ability to ensure actual implementation. However, the companies’ lack of knowledge about the municipality’s work is also a major obstacle.

Table 2 shows the surveyed companies’ interest in engaging in processes which can ensure better implementation of their products. The companies recognise that success of welfare technology depends on the ability to implement in the specific municipal organisation – otherwise the welfare technology ends up merely being an entertaining experiment at best, but never becomes a crucial component in ensuring the future of welfare. The companies therefore express a need to better understand the problems related to implementation in municipal operation and again there is a desire for closer interaction between public and private players. There is also a belief that the companies can bring knowledge and experience from many contexts and can thus contribute to forming a basis for better implementation.

An entire 78 % of the companies find it “important” or “very important” to get input on implementation of their products. Again however, the willingness to pay is less than the will to receive input: 36 % specify being “somewhat” prepared to pay for input, while only 8 % specify “greatly.”

Et living lab med fokus på implementering kan sikre videndeling på tværs af kommuner og private virksomheder. Kunsten bliver så at komme hele vejen rundt om teknologierne og udvikle implementeringsmodeller, der tager højde for både teknologiske, forretningsmæssige og organisatoriske udfordringer.
7.2.3 Also interest in knowledge on sales

Even if the companies have many years of experience with sales and generally perceive the sales process to be their home turf, they experience major challenges in selling to municipalities. Perhaps the companies do not have the necessary network or also do not understand the particular municipal terminology and therefore miss knowledge which is crucial to realising a potential sale. Here there is naturally a big difference whether this we are talking about companies with a large sales force and an accompanying well-developed public customer network or whether we are talking about a small start-up and as yet unknown company.

Table 3 shows the companies’ perception of the importance of getting input for sales. 20 % find sales input "very important" and 44 % find it "important." The figures thus show a great interest in input for the sales process, although it is less than the interest in input for needs clarification and implementation. Again, the willingness to pay is less than the desire to get input.

Many companies point out that living labs can function as a type of demonstration premises where potential customers can stop by and experience the companies’ technology in practice. Many praise the municipalities for taking real shared responsibility for promoting the technologies to institutions and employees and often even make relevant staff and citizens available in connection with demonstrations for other municipalities.
7.2.4 General overview: The companies lack knowledge on problems they can solve

The analysis shows that the public, in the companies’ view, possesses a unique knowledge which can be made available through living labs. The key concepts in this context are the development of more and better methods for knowledge sharing, greater overview of the opportunities and implementation on a large scale.

No link can be shown between the companies’ turnover and their interest in input for needs assessment, implementation or sales. It might look like the companies’ interests are instead conditional on their strategic focus. If, as a company, you invest in developing products in a known domain, living labs are not as interesting as arenas for input as if the development applied to products which are farther from the company’s existing domain.

A living lab must therefore be able to hold a business strategy dialogue with both large and small companies, which makes demands on employees. A living lab may find it advantageous to have a sort of manager with roots in both a public and private context, so they can function as a “translator” between private and municipal terminology.

<table>
<thead>
<tr>
<th>To what degree would you be willing to pay to get input relating to your sales process?</th>
<th>Not important</th>
<th>Not very important</th>
<th>Neither</th>
<th>Important</th>
<th>Very important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greatly</td>
<td>20 %</td>
<td>4 %</td>
<td>4 %</td>
<td>88 %</td>
<td></td>
</tr>
<tr>
<td>Somewhat</td>
<td>8 %</td>
<td>4 %</td>
<td>8 %</td>
<td>4 %</td>
<td></td>
</tr>
<tr>
<td>Neither</td>
<td>20 %</td>
<td>4 %</td>
<td>8 %</td>
<td>4 %</td>
<td></td>
</tr>
<tr>
<td>Very little</td>
<td>20 %</td>
<td>4 %</td>
<td>8 %</td>
<td>4 %</td>
<td></td>
</tr>
<tr>
<td>Not at all</td>
<td>20 %</td>
<td>4 %</td>
<td>8 %</td>
<td>4 %</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Input for sales process and willingness to pay
Living labs and living lab-like activities are carried out by very small organisations – often individuals. Therefore, it is crucial that the work of a living lab is as focused and effective as possible.

Prior to the establishment of a living lab, targeted work should be done to clarify which function you want the lab to handle. The greater the clarity of purpose and ambition, the greater the ability to attract the right companies and thus achieve success with establishment and operation.

Living labs can, as has been shown in the previous pages, be analysed based on their ability to contribute to new solutions which increase productivity and efficiency in the health and welfare sectors. However, we can also look closer at how good living labs is at solving actual development tasks: Do they make the development process more efficient? If there is a need for adjustments or alternatives to be found, which living labs are superior?

In any event, it is clear based on the analysis that more efficient living labs can be created:

1. Collaboration across organisations
2. Specialisation
3. Skill development
4. Export promotion
8.1 Cross-cooperation

Experiences from existing living labs has shown that cooperation across geography and sectors can make the work better.

Several municipalities and regions have come together around living labs in recognition that their needs are converging and that they can reap economies of scale in terms of both costs and dialogue with the market. The Centre for Welfare Technology in Aalborg, for example, was established as an inter-municipal partnership and similarly, a number of North Jutland municipalities are cooperating to implement innovative offerings in the health and welfare sectors. In the Region of Southern Denmark, the Health Innovation Centre of Southern Denmark is the driving force behind a number of Co-Labs, which have the goal of creating development partnerships between hospitals and municipalities.

It is an obvious thing to consider how such inter-municipal and cross-organisational communities can create a further basis for greater activities and professionalism in living labs.

With the strategy "New paths to health and care," Copenhagen Municipality has set goals for "partnerships with other municipalities to solve common challenges for the elderly" based on an assumption that "a collective demand from multiple municipalities can engage larger companies to contribute with solutions."

8.2 Specialisation

A greater degree of specialisation will undoubtedly benefit the living labs which operate on the Danish market – regardless of whether they primarily act as design labs or implementation labs.

**Development of high-level design labs**

Design labs probably require greater knowledge specialisation than implementation labs in order to be able to create value for the customers. This gives cause to consider whether more specialised design labs can be created around a number of the most significant problems – such as dementia, movement and diabetes. It is also advantageous to work to disseminate new methods, approaches and processes for needs clarification in a clear and innovative interaction between private and public players. This will be able to create a deeper knowledge, accelerate learning and form the basis for a closer interaction with traditional research areas at the universities. The goal would be to create a number of dynamic development ecologies which can also attract the most ambitious companies internationally within a well-defined business area. The ambition’s validity is supported by the analysis’ insistence that living labs can become better at disseminating public needs and that the companies want more room to “play” than is possible to do in real practice.
Specialisation in the implementation phase

Although the early stages of the innovation process immediately calls for most of the development of living labs to have a high degree of specialisation, a greater degree of specialisation could also improve the work with the labs which primarily work with implementation. Implementation costs operating hours for the municipalities and it is therefore extremely relevant to create living labs which can improve the municipality’s ability for real and effective implementation.

Med "The yellow Denmark," the consulting firm Public Intelligence has begun establishment of a network of implementation labs which focus precisely on various problems.

The analysis so far has shown that the companies largely perceive living labs as demonstration and testing centres where users, citizens and interested parties come to visit to see, feel and test various technologies in a context which is close to real practice. Living labs thus constitutes a space where mistakes can be made without affecting either staff or citizens. They function as training courses where you can practice the difficult discipline of implementation.

This in turn means that there is a need to develop common methods for implementation which make sense for both private and public parties.

The yellow Denmark

Our Living Labs function as a network which both municipalities and suppliers have the benefit of being in. Because in the network, a lot of knowledge and experience is generated which does everyone good.
8.3 Skill development

Because living labs are typically such small organisations, there is a need to support them with systematic skill development and knowledge sharing around "best practice". Not least because living labs overall faces a number of major challenges:

Methodologically, living labs has significant opportunities to improve. There is a need to establish a practice where development of new solutions consistently occurs in a way which involves both traditional health disciplines and involves new, specialised development disciplines which have emerged in the past 10 years. Not least, there are big gaps when it comes to the "definition phase". This is partly due to most living labs being engaged in implementation and to some extent taking knowledge of needs for granted, but it is probably also a matter of the concept's general lack of maturity and professionalisation.

The handling of user feedback is also an area where Denmark's living labs have a significant task in front of them. There is a need for more registrations of effects from more test implementations over a longer time in the same way as is done in practice in the development of medicines. But since in a living lab context it is often about non-scientific solutions, there is also a need to develop special methods which take into account the difficulty of demonstrating 1:1 causal relationships.

Here, for example, inspiration can be drawn from the theory of change. Quantification of effects is also particularly challenging for today's living labs: The testing opportunities are very limited, if not absent, which is partially due to the municipal economic and nursing/care system not being set up to be able to register activities or conditions on an individual level. Here there is a need for a special effort to allow for anonymous excerpts and breakdowns of the municipal systems at an activity level. Making the operating organisations better able to form a framework for development and testing is a very key task for living labs and requires the development of a culture which makes it possible to think systematically about our own practice and to collect data on a regular busy day. Alternatively, a civil platform can be established to collect user-generated data on conditions, experiences and services.
Business-wise, living labs also faces a couple of major challenges. The first is the need for greater clarity around each lab’s business model: Who would actually pay for what? Where large companies can relatively easily make both time and money available for various collaborations under the auspices of living labs, it is far more difficult for smaller companies to make the necessary resources available. This constitutes a risk that, as a public organisation, we will not realise the innovation potential from smaller and often very specialised companies. There is thus a task to clarify possible business models, which also makes it possible for small businesses to participate. Below, you should think about how knowledge and benefits can be shared between private and publicly operated living labs.

8.4 Promotion of exports and Denmark as a global development and testing centre

Living labs can constitute an attractive platform for foreign companies who want to develop and sell new health and welfare solutions in Denmark because they possess explicit knowledge of the culture and systems in the Danish health and welfare system.

However, in order to be able to create a framework for international development environments, living labs must specialise to a much greater degree than is currently the case and they must acquire a greater understanding of how the problems they address look from a global perspective. Denmark can be interesting as a development laboratory, but as a market, Denmark is too small and our welfare model is too special for large, global players to want to invest resources in developing special Danish solutions.
9. SOURCE REFERENCES

1. **Business Model Canvas:**

2. **Businesscases – examples of tools**
   [http://www.kl.dk/ImageVaultFiles/id_64459/cf_202/Gevinstrealisering_-_.Business_case_0_5.PDF](http://www.kl.dk/ImageVaultFiles/id_64459/cf_202/Gevinstrealisering_-_.Business_case_0_5.PDF)

3. **CEKU, Simulation center, Rigshospitalet**
   [http://cekuku.dk/km_ceku/](http://cekuku.dk/km_ceku/)

4. **Design Thinking, Tim Brown, IDEO**
   [http://www.ideo.com/about/](http://www.ideo.com/about/)
   [https://hbr.org/2008/06/design-thinking/ar/1](https://hbr.org/2008/06/design-thinking/ar/1)

5. **DIMS (Danish Institute for Medical Simulation))**
   [http://www.regionh.dk/dims/menu/](http://www.regionh.dk/dims/menu/)

6. **Elsi Technologies**

7. **EValueHealth**

8. **Falck Hjælpemiddler**
   [http://www.falckhm.dk/om-falck-hjaelpemidler/](http://www.falckhm.dk/om-falck-hjaelpemidler/)

9. **Institut for Hverdagsteknologi [Institute for everyday technology]**

10. **KL’s Center for Velfærdsteknologi [Center for Welfare Technology]**

11. **Living Lab Strandvejen**
    [http://livinglabstrandvejen.kk.dk/](http://livinglabstrandvejen.kk.dk/)

12. **People Value Canvas:**
    Wildevuur, S. et al. (2013): CONNECT. Design for an empathic society, Bis Publishers

13. **Seniorland**
    [http://www.seniorland.dk/?gclid=CiRHzLnao8QCFcT7cgodGkYARw](http://www.seniorland.dk/?gclid=CiRHzLnao8QCFcT7cgodGkYARw)

14. **VTV – Velfærdsteknologivurdering [Welfare Technology Assessment], Danish Technological Institute**
    [http://www.teknologisk.dk/ydelser/vtv-velfaerdsteknologivurdering/32944](http://www.teknologisk.dk/ydelser/vtv-velfaerdsteknologivurdering/32944)

15. **Theory of Change**