

SeAMK

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Frami Food Living Lab Manual

Food Living Labs Connecting People - Project A76110

SeAMK 

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Terms and Abbreviations

Frami Food Living Lab	A user-driven innovative development platform combining research, development and innovation between educational institutions and businesses.
Business cluster	Geographical concentration of businesses, students and other actors within a given area. The members of a cluster of businesses are linked together through cooperation.
Food province	Term used for the food region of South Ostrobothnia. Includes the entire food chain from field to fork.
SS4AF	Europewide Smart Sensors 4 Agrifood network, whose members provide living lab services to their partners.

1 Introduction

Living lab can be defined in many ways. In the network of educational institutions and enterprises, it means increasing interaction, increasing business and student cooperation, and close dialogue between research and development. Living lab is based on a development platform that provides companies with facilities and services for product development. The aim is to create an innovation cluster, i.e., a business cluster, comprising life science and technology industries and their manufacturers and users. The creation of a business cluster will also increase cooperation between enterprises. This cooperation will bring innovation, new services and skills to the region. The aim is to create an organised business cluster that will remain a permanent innovation hub in Southern Ostrobothnia after the project. Food Living Labs Connecting People (A76110) - work package 2 aims to build and implement a network of Living Labs, providing services to organisations, businesses and educational institutions. The FLLCP project is funded by the European Regional Development Fund (EAKR) and the Seinäjoki University of Applied Sciences (SeAMK). The project will be implemented by SeAMK between 1st May 2020 and 31st June 2023.

The food industry in South Ostrobothnia accounted for 17 % of the turnover of the food industry in the whole country in 2021 (Tilastokeskus, 2022). In 2021, there were 122 establishments, of which 105 were food manufacturers, 15 beverage manufacturers and two manufacturers of machinery for the food, beverage and tobacco industries. The percentage of establishments in South Ostrobothnia accounted for 5% of the total number of food businesses in Finland in 2021. The percentage of turnover is considerably higher than the percentage of establishments, so South Ostrobothnia can be considered a significant food region nationwide. Three large companies in South Ostrobothnia, Atria, Valio and Juustoportti, account for the majority of turnover in the region.

The main actors providing Frami Food Living Lab services are SeAMK, Sedu Seinäjoki and Foodwest Oy. This manual describes in more detail the formation of the activity, possibilities of using the services and facilities and the building of the business cluster and its benefits.

2 Business cluster

The launch of the Frami Food Living Lab requires formation of a cluster of food operators. A business cluster is an innovation cluster that aims to increase cooperation between companies within the region and between companies and educational institutions on a permanent basis. South Ostrobothnia has a wide range of food businesses of all sizes. There are also equipment manufacturers, small food processing companies and larger food processing plants.

A cluster refers to a geographical concentration of companies, professional organisations, educational institutions, and different entities that are linked together by cooperation with other cluster members (Abraham, 2014). Companies compete with each other, but also complement each other with knowledge, skills, services and equipment. One of the main objectives of a cluster is to bring innovation to the region and create new activities and products. Activities include research and development.

The cluster companies have been collected over the period of 2020–2023. Company representatives have met either at the SeAMK premises or in the companies. Relief of the global COVID-19 pandemic allowed business visits and face-to-face meetings with company representatives. Each company that wants to join the cluster has been introduced to the SeAMK facilities and services and enquired about their interest in the Frami Food Living Lab activities. Potential investments, cooperation opportunities and future development have been discussed in the meetings.

The actors that have signed the Living Lab business cluster agreement are shown in figure 1 by industry sector. The figure shows a map of South Ostrobothnia, where the companies are positioned by location and industry. Included are meat industry, dairies, bakeries and equipment manufacturers. It can be seen from the graph that the operators in the 'other' group are the most involved in the cluster. This category includes distilleries, small and organic farms, manufacturers of confectionery and packaging materials, and berry powder processors. Interviews with these companies revealed that the Frami Food Living Lab services are particularly interesting concerning product development environments and student collaboration at SeAMK. Small and medium-sized enterprises have limited knowledge

and resources, so they will benefit most from the Frami Food Living Lab and the business cluster.



Figure 1. Business cluster enterprises by industry.

3 SeAMK

The Seinäjoki University of Applied Sciences (SeAMK) is located near the centre of Seinäjoki on the Frami campus, which has a total of about 5 000 students and 400 staff members (Seinäjoen ammattikorkeakoulu (SeAMK), n.d.-a). SeAMK offers education in six different fields of study and high quality research, development and innovation services, which makes it a nationally and internationally influential institution. SeAMK works closely with companies in the region and emphasises entrepreneurship in every field of study.

SeAMK educates students in three sectors of food studies: food processing and biotechnology, hospitality management and agriculture and natural resources. The teaching in these fields of study focuses on sustainable food solutions. Food processing and biotechnology studies include product development, food processes and hygiene skills. It is also possible to complete a master's degree in Food Chain Development at SeAMK.

In the autumn of 2021, SeAMK started an international bachelor degree program Agri-food Engineering, which combines the studies of an agrolgist and a food engineer (SeAMK, in.d.-b). The program is based on a field-to-fork approach to food production. The training will give companies in Seinäjoki an opportunity to internationalise, for example by offering a work practice place to an Agri-food Engineering student.

SeAMK offers a wide range of services to companies and organisations. The services are shown in figure 2. The services can be divided into three different categories: student work, research, development and innovation services, and paid services. The paid services include continuing education and training provided by SeAMK on topics that benefit businesses and their employees in the changing world. The Frami Food Living Lab activities are included in the paid services, but for example an assignment offered to a product development study course is free of charge because the work is carried out by the students. The students also provide services such as work practice and thesis studies, in which the company can be involved as a client or an employer. Research and development projects include a variety of projects in close cooperation with companies.

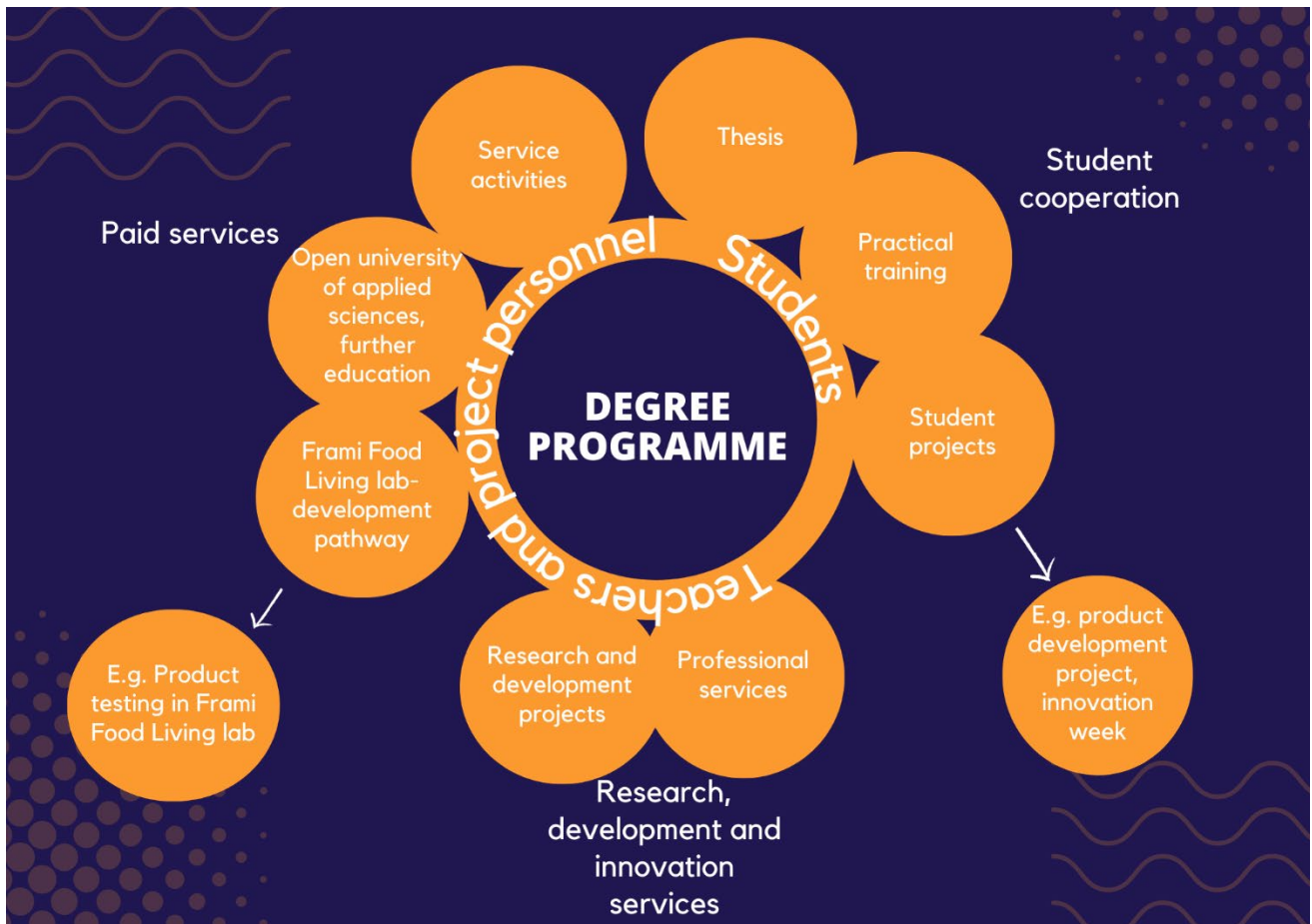


Figure 2. SeAMK services.

3.1 Research, development and innovation services

Research, development and innovation (RDI) activities play a major role in the activities of SeAMK. These activities are generally development work or applied research serving the needs of the region. The RDI team for sustainable food solutions had a total of 43 projects in January 2023 (Mäki, personal communication, 2023). The total budget for these projects in 2023 is €3 million. The projects will involve agrologists, bachelors of hospitality management, food processing and biotechnology engineers and other experts who cooperate with companies, public sector actors and other communities. These experts support the development of businesses and operators. The projects organise free workshops, webinars, and seminars for people from micro-enterprises to large organisations.

3.2 Student cooperation

At SeAMK, cooperation between students and companies is considered very important. Cooperation serves both parties, as the student gets keys to working life and the company can get to know a potential new employee and receive new innovative information from the students. SeAMK has several international students, who offer the companies the opportunity to internationalise and learn international skills. Figure 3 summarises the working life periods during the food processing and biotechnology studies, which the companies can use in their own development.

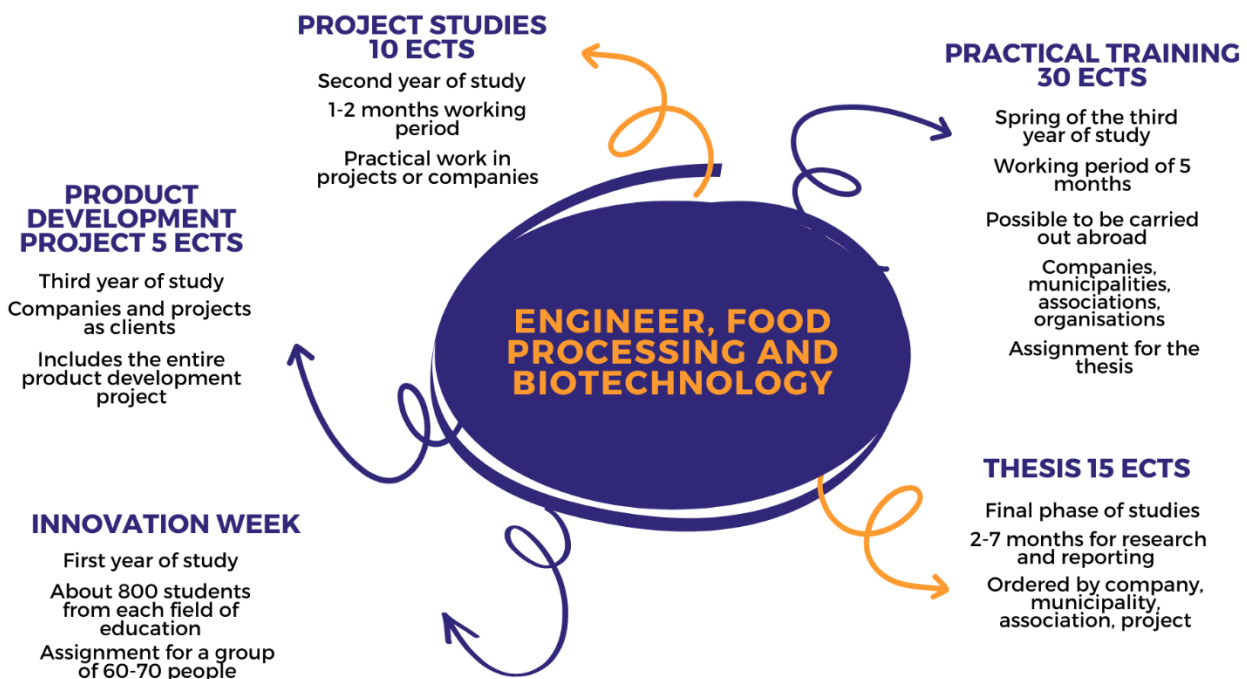


Figure 3. Food processing and biotechnology, working life cooperation.

3.2.1 Innovation week

In food processing and biotechnology studies, cooperation with companies takes place every academic year. During the first year, there is a SeAMK-wide Innovation week, where about 800 students from different study fields work on development challenges for different clients (Uusimäki, n.d.). Around 60 - 70 students work on one assignment for a week and at the end of the week the groups present their ideas to the assignors. Participation in the

Innovation week costs the sponsor €250. However, there is a satisfaction guarantee, because only successful projects will be charged.

3.2.2 Project studies

During the second year of the SeAMK studies, a ten-credit project study period of approximately 1 - 2 months will be carried out. Project studies can be performed in different projects, companies or associations. The project leader will have an excellent opportunity to make use of the students' innovations and skills, as well as to get to know a potential future trainee or employee.

3.2.3 Product development project

In the third year, the students will complete a product development course, during which they will implement an innovative new product (SeAMK, n.d.-c). Companies can sign up free of charge as sponsors, but they will be responsible for the postage and other costs. The sponsor provides the students with the raw material, on the basis of which they start to develop a new product. The product development project will include ideation, market research, product development, packaging and documentation. The company will have access to the material produced by the students and may also impose a confidentiality agreement on the development work, which the students will sign and agree to respect.

3.2.4 Practical training

There is one obligatory practice period in the study program of Food Processing and Biotechnology. It takes place in the spring of the third year (SeAMK, .d.-c). The duration of the practice is five months and it can be completed in one or more parts. The practice period is an excellent opportunity for the company to find a potential trainee or to recruit a new employee for the future. Trainees can be recruited by companies, municipalities, associations, organisations and projects. Their tasks can include management, marketing, product development, packaging development, consultancy, supervision and planning.

3.2.5 Thesis

The degree in Food Processing and Biotechnology requires the completion of a thesis. The scope of the thesis is 15 credits, which corresponds to approximately 400 hours of work (SeAMK, n.d.-d). The thesis is usually carried out for a client, so companies, municipalities, projects and various organisations can apply for a thesis writer. The thesis often includes a written overview of the topic, a functional study, and reporting. If the thesis is done for the same sponsor as the work practice, it is a good idea to organise time for research within the framework of the practice period. The sponsor has an opportunity to gain important new information on the topic, development suggestions, new ideas and guidance. If you cannot find a suitable thesis writer through work practice, you can register your interest in the SeAMK thesis bank or contact our practical training supervisor of the Food Processing and Biotechnology program.

3.3 Paid services

SeAMK services in the food sector include paid expert services. The expert services can be used for product development, food hygiene and food safety (SeAMK, n.d.-e). Experts can be found in every part of the field to fork chain. The food processing and biotechnology experts have the Frami Food Living Lab at their disposal. The lab can be used by external operators as well. The lab facilities offer a wide range of possibilities to produce different food products at a laboratory scale. In addition, SeAMK has a sensory laboratory, where taste tests can be organised with a student panel as well as laboratories for microbiology and chemistry. More about the Frami Food Living Lab facilities in chapter 4.2.1.

4 Living lab

There is no single appropriate definition or manifestation of a living lab (Heikkanen, 2012). It can be applied according to the principles of open innovation. However, from a conceptual point of view, a living lab is a research, development and innovation activity with the contribution of a competent team of experts. Living lab activities fulfil the basic duties of universities of applied sciences: teaching, research and regional development. The launch of the activities through the cooperation between SeAMK, Sedu and Foodwest supports the above-mentioned basic duties. The food sector in the region of South Ostrobothnia is large and growing, with expertise in every area of competence. The launch of the Frami Food Living Lab will increase knowledge and cooperation between companies and educational institutions.

One purpose of the Food Province 2030 - Keys to Success from Field to Fork project has been to build a strategy and development goals for the food sector in South Ostrobothnia for 2023 - 2030 (Välisalo et al., 2022). The strategy defines five priorities, two of which are part of the Frami Food Living Lab: Food-PRO-vince and Food Province family. The measures for the implementation of Food-PRO-vince are based on the development of the food sector, ensuring the continuity of education, training and RDI activities. Measures include, in particular, targeting education marketing at Generation Z, raising the level of training of those working in the food sector and organising digital training for food businesses. The aim of the Food Province family is to unify the food network by bringing together different actors in the sector, so that they can meet and find common interests in exports etc.

A living lab is a network that is mainly self-organising, as the activities are based on voluntary cooperation (Leminen et al., 2012). The activities can be divided into four different categories according to the guiding actor and the objective of the living lab. These are; user-driven, supplier-driven, utilizer-driven and enabler-driven. In these models, there is one actor who is the most active one but who does not exercise power over the others. The Frami Food Living Lab service, built within the Food Living Labs Connecting People project, can be placed in the enabler-driven living lab framework. It aims at regional

development in the long term. This will be done by increasing cooperation between actors and raising awareness of the services.

Being part of the regional Frami Food Living Lab network connects companies to the international Smart Sensors 4 Agri Food (SS4AF) network, which gives companies new opportunities for collaboration, visibility and networking with other stakeholders in the innovation ecosystem (Keleti et al., 2020). Figure 4 shows the European wide Living Lab actors that make up the SS4AF network. Living lab actors are active in countries such as Belgium, France, the Netherlands, Germany and Hungary. Cooperation between companies is not limited to regional living lab activities but can also take digital advantage of innovation ecosystems in other regions. Participation in the network gives the participant an opportunity to learn about new technologies and digital solutions. A technology manufacturer or provider on the other hand, will have an opportunity to learn more about the challenges facing the food industry and offer solutions to the actors. However, the aim is not only to present their own products or services, but to establish trust and cooperation and to find common interests in terms of collaboration.



Figure 4. Smart Sensors 4 Agrifood Living lab-network (SS4AF, n.d.).

4.1 Facilities

In Seinäjoki, vocational and university of applied sciences level food education is provided by Sedu and SeAMK. High-quality facilities are provided for teaching and they are available to external actors through the Frami Food Living Lab. Sedu and SeAMK can use each other's facilities for teaching. SeAMK has shared equipment with Foodwest Oy, a contract manufacturer located in Seinäjoki.

4.1.1 SeAMK laboratories

The Frami Food Living Lab is located on the campus of the Seinäjoki University of Applied Sciences in Frami A. It was completed at the same time with the microbiology and chemistry laboratories in 2019, which made it an ideal place for different phases of product development. The Frami Food Living Lab is a highly adaptable hygienic space where a wide range of food processes can be performed. It is possible to work in wet or dry processes regarding meat, milk, grain and food technology. The laboratory has equipment for bakery production, homogenizing of oat drinks, examination of the structure of the products by viscosimeter and structural gauge, imaging with machine vision, microscope and hyperspectral cameras and sterilisation of canned food in autoclaves.

Furthermore, the Frami campus has laboratories for chemistry and microbiology. In the chemistry laboratory, it is possible to carry out basic chemical analyses and NIR analyser standard curves for different raw materials. In the microbiology laboratory it is possible to carry out shelf-life tests, as well as basic analyses of total bacteria, moulds etc.

The sensory quality and consumer experience of a product developed in the Frami Food Living Lab can be verified in the Frami A sensory laboratory. It is also possible to organise a consumer panel with a panel of students to assess the taste, appearance, usability and consumer interest in the products. The room has a separate evaluation cubicle for each evaluator to make the evaluation situation as authentic as possible.

4.1.2 Frami Food Living Lab development in the future

Food Living Labs Connecting People (A76110) project will improve the Frami Food Living Lab services to companies and other operators by starting the Living Lab activities. The services and facilities of the Frami Food Living Lab will be expanded in the future, as the Future Frami Food Lab Development Project (A401089) started in January 2023. The development project will be accompanied by an investment project with the same name (A401089). The aim of the project is to strengthen the food technology competence in South Ostrobothnia and to improve the quality and competence of teaching in the region. Within the framework of the project, the Frami Food Living Lab facilities will be expanded to reflect better the stages of the food production process. The equipment purchases will pay special attention to the possibility to process proteins of plant and animal origin. For example, an extruder and a spray dryer are on the purchase list.

The current food lab does not have enough space for new equipment, so the Frami Food Living Lab will be expanded to its full capacity. The laboratory will be divided into two sections according to the level of hygiene. High hygiene processes will be located in the old premises and the teaching space, currently used as an automation laboratory, will be converted into a testing and process environment in accordance with food legislation. The Wise Frami Food development project (A77622) and the parallel investment project (A77629) are involved in the development of the food lab, in particular in its digitalisation. The aim of the project is to provide a digital demonstration environment that will allow companies to develop their own information systems. They will also have a testing environment that will allow them to network with other service providers' systems. In the Frami Food Living Lab, digitalisation has been carried out on a manually operated homogeniser, which was previously controlled manually. The digitalisation allows more data to be extracted from the process and the behaviour of the raw materials to be monitored more efficiently.

4.1.3 Prikka

The teaching restaurant Prikka, run by the hospitality management students, is located in Frami E on the SeAMK campus (Prikka, n.d.). The restaurant serves lunches and private

dinners using local and organic products. People from outside SeAMK can come to Prikka for lunch or book a private event. Prikka is part of the SeAMK Frami Food Living Lab activities, as the high-quality restaurant kitchen can be used to develop products for testing by the restaurant customers. The usability and functionality of the developed product, as well as consumer interest, can also be tested in the restaurant.

4.1.4 Sedu Törnäväntie

Sedu Seinäjoki Törnäväntie campus is a venue for professional training program for food manufacturers. High quality facilities have been built on the campus for bakery production, confectionery and meat production on a pilot scale. The production facilities and equipment are part of the Frami Food Living Lab services. In Sedu, the user of the Living Lab activity will have a closer working experience and a more peaceful working environment than in practical production.

The meat facilities and equipment can be used to produce a wide range of meat products, from whole to raw-cut carcasses. The equipment for raw meat products can be used to make minced meat, strips and cubes. A needle salting machine is also available for salting hams. The premises can be used for products such as grilled, cured and cased sausages and sliced and canned meat products. The cooking oven can accommodate 100 - 120 kg of batches at a time and the products can be smoked, for example with alder smoke.

Sedu bakery and confectionery department can produce almost all types of bakery-confectionery products. The equipment is equal to professional bakery equipment and the products can be produced in batches of tens of kilos to hundreds of kilos. The bakery equipment includes a rolling machine, a bread line, dough machines, chopping machines, raising cabinets and baking ovens.

Sedu production facilities are used to make products which are sold in their own shop to the in-house staff and even to external consumers. The production facilities are hygienically designed and the product safety is controlled. Sedu premises are also open to external operators for product development or testing purposes.

4.1.5 Foodwest

Foodwest Oy factory, which focuses on product development and contract manufacturing of products, is located in Seinäjoki in the Roves industrial area. Additionally, Foodwest has offices in Tampere and Helsinki, with a special focus on consumer insight and market research.

According to Foodwest CEO Harri Latva-Mäenpää (personal communication 2.3.2023), Foodwest provides food industry operators with expert services (from idea to product) that enable them to develop and grow their businesses both domestically and in foreign markets. He explains that these services are divided into following themes: product idea creation and concept development of new products and applications, consumer insight and market research (e.g. concept and product testing at home, in the field or by online studies), product development and application testing, product information and nutrition, quality and food safety consultation, contract manufacturing and packaging of products and piloting trials.

According to him, in the core of the work is consumer-led product development, where the consumer and brand needs are taken into account throughout the development process, thereby improving the likelihood of commercial success of new products.

Latva-Mäenpää notes that the Seinäjoki factory has high-quality facilities for product development and manufacturing of food products. The first batches of the product development process can be made in a laboratory/test kitchen scale (gram/kilogram scale), whereas the next experiments can be executed in a pilot scale, for example in a food service product development facility (10 - 500 kg scale). Product development can test and simulate various industrial processes and test new raw materials, and the factory has access to a wide range of technologies used in the food industry. As a good example of advanced technologies, he regards the hybrid twin-screw extruder of Foodwest, which can process plant proteins etc.

Latva-Mäenpää emphasises the wide versatility of Foodwest production facilities, with areas organised for wet and dry processes, where for example a production line can be built as required (200 - 500 kg scale). According to him, the production facilities include

continuous pasteurisation /cooling and a bottling lines. Foodwest specialises in particular in the production of liquid products that can be packaged in a variety of bottles and e.g. plastic bags/sachets. The design of the facilities has taken into account allergen management, and there is a separate ATEX approved area for alcohol processing. The Foodwest factory has the capacity to produce and package smaller batches for product testing to gain consumer insight.

5 Development path

Figure 5 shows an example of how the development path for Frami Food Living Lab activities can be implemented. The Living Lab development path is usually company driven. It can start with a pre-branding of a new product idea for the company. The new product will be developed to serve the needs of consumers and to increase the company's turnover. The company has neither the equipment or the know-how to manufacture the product and does not want to invest in equipment before the results of product development and consumer testing are available. They want to be sure of the usability and consumer interest of the product under development before considering the possibility of investing in equipment. The company is not sure whether there is room for a new product in their production, so subcontracting may be the most viable option.

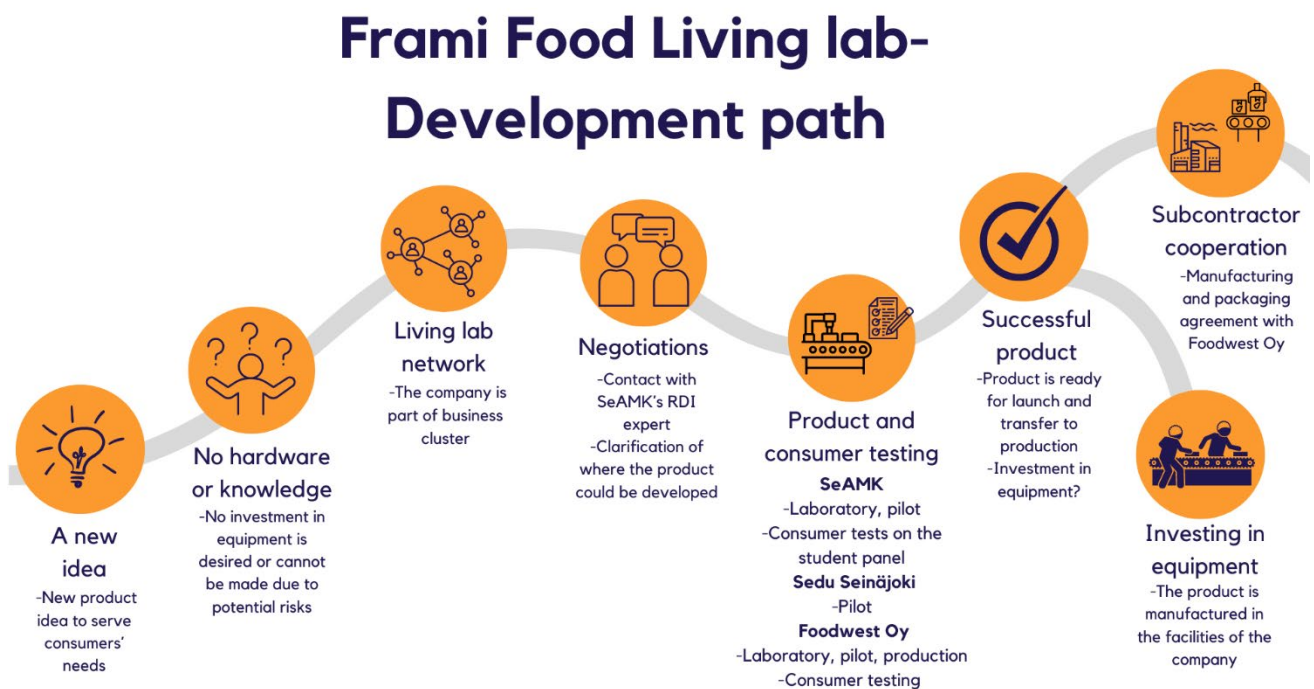


Figure 5. Living Lab-development path.

In this case, it is beneficial to the company to be part of the regional Living Lab network and the business cluster. The Frami Food Living Lab activities are introduced to the company and after that they can sign a cooperation and business cluster agreement with the RDI experts of SeAMK. As a result, they know how to contact the RDI expert and

negotiate where and how they could develop their product. The negotiations will cover the equipment, batch size and other requirements needed for the product development. It is possible to start the product development work on a laboratory or pilot scale at the SeAMK Frami Food Living Lab, on a pilot scale with the Sedu meat and bakery equipment or at Foodwest, where manufacturing can be done on a laboratory, pilot and production scale.

In addition to product development and manufacturing tests, the product must also be tested by consumers. At SeAMK, it is possible to organise consumer research with a student panel in a sensory laboratory. Students from other study programs can be recruited for product evaluation, in order to ensure a broad and comprehensive sample. At Foodwest, sensory evaluations can be organised for consumers in the Foodwest test facilities in Helsinki, Tampere and Seinäjoki (Foodwest, n.d.). Consumers can also test the products in their home kitchens in an authentic environment.

After successful product development and consumer testing, the product is ready to be launched. The company has to determine whether it is possible to invest in equipment in its own production facilities or whether to make a manufacturing and packaging contract with Foodwest at its Seinäjoki site.

This is just one example of how the development path of the Frami Food Living Lab- activity can proceed. For each company participating in the activity, a company-specific pathway is designed together with an RDI expert. The development path can also be an intangible flow of knowledge from one expert or specialist to another.

6 Summary

The Food Living Labs Connecting People -project aimed to create an innovation cluster, i.e., a business cluster. The cluster was made up of actors from the food industry and equipment manufacturers in South Ostrobothnia Food Province. The Food Province is ready to cooperate, share knowledge and bring new ideas to the region. The Frami Food Living Lab platform in South Ostrobothnia will become part of the Smart Sensors 4 Agri-food network, bringing internationality to the region. The Frami Food Living Lab activities will become a permanent development platform that the companies can use in their own development. This will further strengthen the importance of the food region of South Ostrobothnia at municipal and national level.

The introduction of the Living Lab service will increase cooperation within the Food Province. Businesses will be more aware of how they can make use of the three main organisations of the Frami Food Living Lab service. Cooperation between businesses and educational institutions will deepen and the Frami Food Living Labs will become low-threshold testing facilities. The development work may result in totally new, innovative food products that meet the consumers' needs. In the Frami Food Living Labs, success is allowed, but so is failure. All development work will not necessarily result in new products, but testing can provide important information for the future. The aim is to create a low-threshold product testing environment for the industry.

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