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AMMATTIKORKEAKOULU
University of Applied Sciences

Anne Äyväri and Tuija Hirvikoski

Review of Finnish social and health care ecosystems' websites supporting the co-creation and testing of innovations

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1. Introduction

THIS REVIEW IS a partial report of the Co-creation Orchestration (CCO) project, funded by the Finnish Ministry of Education and Culture and Laurea University of Applied Sciences operating in Finland (CCO, 2021). The CCO project studies and positions higher education institutions (HEIs) in relation to open innovation ecosystems and their multi-stakeholder co-creation and experimentation activities. In this context, multi-stakeholder refers to the joint innovation activities of HEIs and companies as well as the public, third and fourth sector operators.

Chapter 1.1 of the review describes the concepts and principles that guide the publically supported co-creation and experimentation[1] activities among the higher education institutions and their partners in Finland and in the Member States of the European Union. The chapter was written by Tuija Hirvikoski, PhD. She is the scientific manager of the CCO project and holds expert positions in the fields of open science and open innovation in the European Commission.

Chapters 1.2–6 of the review have mainly been written by Anne Äyväri, D.Sc., while working as a Principal Lecturer at the Laurea University of Applied Sciences. The chapters provide a review of platforms[2] supporting open innovation processes in the Finnish social and health care ecosystems. The descriptions of the platforms are based on the information given on the websites of the ecosystems and their orchestrators.

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1 The CCO project uses the term *experimentation* as this is in accordance with the Finnish Innovation and Experimentation Policy. The websites presented in this review primarily use the term *testing*, and therefore the title of this review uses this term. However, the term *experimentation* is used in the chapters 1 and 7 of the review as testing refers generally to the testing of a concept, product, or technology and is thus a narrower term than experimentation that refers to all the experimentation activities throughout the entire innovation process.

2 In this review, we have used different terms as the terminology among the object organisations varies. By *social and health care ecosystems,* we refer to all the stakeholders involved in the ecosystem operations. By *websites,* we refer to the publicly available information shared online by the ecosystems. Following the terminology used by the object organisations, this review also uses terms *innovation platform*, *digital innovation platform*, *open innovation platform*, *(open) innovation environment*, and *national growth ecosystem*. See sub-chapter 1.2 for more information.

Chapter 7 discusses the results of the review from the perspective of higher education institutions. Both authors of the publication have produced content for this chapter.

1.1 CONCEPTS AND PRINCIPLES GUIDING CO-CREATION AND EXPERIMENTATION FOR INNOVATION

Multi-stakeholder innovation activity is not a new phenomenon, as it began to be developed and studied as early as the 1970s on the initiative of the Organisation for Economic Co-operation and Development (OECD). The focus of research and development has varied over the past decades, throughout which innovation activities between several actors have been referred to with different concepts describing the nature of the activities of that time. The key concepts affecting the development of innovation activities and the role of HEIs are presented below. The aim of the review is not to rank them in order of superiority but rather to emphasise the continuous development of the phenomenon and to help the reader to consider how models and concepts suitable for different purposes and situations complement each other and how they could be used and further developed. These concepts have each contributed to creating preconditions for the tendency to open up science, innovation and learning which has accelerated in the 2020s.

In the past, innovations were believed to emerge primarily based on codified scientific or technological data when scientific data is transferred to companies and other beneficiaries in a linear data transfer process. This linear innovation model is referred to as STI. The abbreviation stands for Science, Technology, and Innovation (Jensen et al. 2007). Bengt-Åke Lundvall (1985) from the University of Aalborg identified the existence of a so-called DUI innovation model when examining national and regional innovation systems. In the model, ecosystem operators exchange experiential information in a framework of informal interaction. Learning, a key requirement for innovation, takes place in these processes. The abbreviation DUI is derived from the model's core message: learning-by-Doing, learning-by-Using, and learning-by-Interacting (Doing, Using and Interacting). (Jensen et al. 2007.)

According to Mario Davide Parrilli and Henar Alcalde Heras (2016), the STI model has a greater impact on technological innovations, whereas the DUI model has a greater impact on commercial or organisational and other non-technological innovations. In multi-stakeholder co-creation and experimentation, both are usually needed. It could be said that the DUI model is somewhat closer to the actual needs-based multi-stakeholder co-creation of innovations, whereas the STI model produces unique scientific information for the innovation process, which can also generate breakthrough innovations. For example, the rapid development of the Covid-19 vaccine was possible through cooperation between the public and private sectors and higher education institutions only because scientific knowledge and data acquired over decades from basic research (State-of-play on the PACT) was available.

In the late 1980s and early 1990s, cooperation between disciplines intensified, and the aim of the cooperation was to solve problems in the real world. To describe this change, Gibbons et al. (1994) launched the concept of Knowledge Creation Mode 2 that highlighted applied research and entrepreneurial higher education institutions.

In 1995, Henry Etzkowitz and Loet Leydesdorff presented research results showing that the knowledge creation takes place in cooperation between the parties of a so-called Triple Helix: University-Industry-Government Innovation. The terms triple, quadruple and quintuple helix are widespread and also rooted in the vocabulary of innovation policy and innovation operators in the 21st century. One of the exceptions to the prevalent use of these terms is the European Institute of Innovation and Technology (EIT), which uses the term Knowledge Triangle to describe universities, companies, and research centres (EIT KIC 2021).

Another particularly relevant concept regarding co-creation and experimentation is Open innovation 2.0 (OI2) that describes the co-creation, rapid trials, testing, validation, and deployment of multiple simultaneous and mutually enriching innovations in multi-stakeholder and open innovation ecosystems. The Open Innovation 2.0 model was created by the Open Innovation Strategy and Policy Group (OISPG), consisting of the European Commission, leading technology companies and researchers. The model was described by Martin Curley and Bror Salmelin in 2013. In addition to innovations created based on science and information on market and end-user needs, they can also emerge from so-called lucky coincidences (serendipity). Serendipity becomes possible when many operators share the risks and results related to innovation activities as well as the information and resources that are needed to generate them. The European Commission (2016) publication describes the conceptual development that preceded the introduction of the OI2 model. The publication discusses both open innovation and open science, thus creating preconditions for the development of the science and innovation policy of the 2020s, which will be discussed later in this subsection.

Scholars and practitioners also note that multi-stakeholder innovation co-creation can take place in various environments, for example open innovation ecosystems (Fasnacht, 2018, European Commission, 2016), regional innovation ecosystems (Lappalainen, Markkula & Kune, 2015), or local and global Living Lab environments and networks (Aversano 2016). These environments add to the current terminology used about multi-stakeholder innovation co-creation.

As previously stated, the focus of the research and development regarding multi-stakeholder innovation activity has varied throughout the decades, and most recently, in the 2020s global problems and increased global competition have led to a new emergence of multi-stakeholder and participatory research and innovation activities. Today's higher education institutions and publicly funded innovation co-creation and experimentation activities are guided by the key objectives and principles following multi-stakeholder and participatory principles. Hence, with the CCO project and its multi-stakeholder activities we promote both national and European Union objectives and principles.

Multi-stakeholder innovation co-creation is closely tied to the inclusiveness principle, as both emphasise the importance of inclusion and active participation of diverse stakeholders with different perspectives, experiences, and competencies. In line with the inclusiveness principle, for example the Strategic Research Council of Finland (LITERACY research programme 2021) states that "researchers' and interaction partners' commitment to the co-creation approach involving different perspectives must be taken into account in project activities across the board, starting with project planning and setting goals". Therefore, CCO project endorses and applies this statement with its activities, including this review.

In innovation, co-creation and continuous experimentation in a participatory manner are equally crucial. For example, in Finland, the CCO project has learned that innovation benefits from the Finnish culture of experimentation which emphasises development by experimentation and how learning from fast failures promote innovation. Apart from promoting learning, experimentation saves time and resources and therefore minimises the risk of more costly failures such as fully developed solutions not meeting the needs of the end-users. In addition, the culture of experimentation challenges people to question and to think critically.

Finland is an example of a country where continuous experimentation, as described previously, has become part of the governmental policy. In line with this, the national research and innovation policy and related funding have supported the rapid uptake of multi-stakeholder co-creation and experimentation activities. The vision of the Research and Innovation Council is that "Finland will be the most competent and attractive innovation and experimentation environment in 2030" (Growth ecosystems as a tool for new

business and innovation policy, n.d.). The objective of Prime Minister Sanna Marin's government is to make Finland "the most competent environment for experimentation and innovation in the world, producing sustainable solutions to societal challenges" (National Roadmap for Research, Development, and Innovation, 2020).

In the global knowledge and innovation economy, facing socially extensive and complex problems requires the competences, resources, and cooperation of several operators. Such problems include, for example, climate change or the economic and public health challenges of ageing societies. These problems are referred to as wicked problems. In scientific contexts, the difficulty or impossibility of solving wicked problems is often highlighted. For example, in the CCO project, facing such problems through strategic cooperation across disciplines and organisational, cultural, and national boundaries is called multi-stakeholder innovation co-creation and experimentation.

It is important to study and understand the connections and opportunities between the Blue Sky Science, applied research, and innovation in the context of HEIs' third mission i.e. regional development. Thereafter it is possible to enhance and develop the preconditions for participatory research, development, and innovation activities (RDI) of higher education institutions and their interaction partners collaborating in innovation ecosystems. As the focus of the development is mainly on publicly funded activities, this review also aims to anticipate new principles and initiatives that guide not only national but also European HEIs, RDI activities and their funding.

In line with the previously explained concepts and principles, in particular the European Universities Initiative and the European Research Area (ERA) Pact, which was co-created in spring 2021 between the European Commission, the Member States of the European Union and stakeholder representatives, will fundamentally transform HEIs and their cooperation with other operators in the near future. Already, since 2000, the ERA has made the European research and innovation system less fragmented and has contributed to the European internal market development of knowledge and innovation between universities and stakeholders (ERA Communication, 2020).

The objective of the ERA Open Science initiative is to further the impact of HEIs' research activities and their collaboration with operators in thematic, regional, and global innovation ecosystems. The recently introduced European Open Science Cloud service on the other hand aims to improve the quality of research and the usability of research results and materials. Sharing scientific knowledge and research data also improves the quality of innovation activities and shortens the time between the development and deployment of innovations (European Commission, Open Science, n.d.).

The availability of scientific data is promoted through the FAIR principles of the EU and OECD. The aim is that research materials are as open as possible and as closed as necessary. The aim is to make the data easily Findable, Accessible, Interoperable and Re-usable, i.e. FAIR (European Commission, Open Science).

From the perspective of this review, it is important to be aware that better access to research data improves the preconditions for facing wicked problems and developing socially effective and commercially sustainable solutions through cooperation between researchers, commercialisers and the public sector. Similarly, sharing insights, information, and data generated by experimental innovation activities with researchers is also believed to generate new research topics and improve the quality of research.

The ERA Pact (State-of-play on the PACT), the Open Science initiative (European Commission, Open Science, n.d.) and the Missions policy introduced by the new European Framework Programme (European Commission, Missions in Horizon Europe) promote the principle of including citizens in RDI activities which are carried out with public funds. The programmes funded by the European Union refer to this principle for

instance by the terms citizen science, citizen engagement and civic participation. In Finland, various methods have been developed and successful results reached as citizens have long been involved in various open innovation and open science activities.

Regarding the ongoing transformation challenging HEIs, the most ambitious is the European Universities Initiative (European Commission, European Universities Initiative), which also affects the national funding of higher education institutions and their motivation and opportunities to operate in regional innovation ecosystems. The initiative aims to promote European values through cross-border networks of HEIs and stakeholders while improving their position in global competition. The aim is that multidisciplinary cooperation between HEIs and their associated partners across disciplinary boundaries will create solutions to major societal challenges while at the same time addressing skills deficiencies in Europe. In addition to science-based teaching, HEIs that have received European Universities funding must implement so-called challenge-driven RDI activities. In the challenge-driven RDI activities, multi-disciplinary teams creating knowledge and innovations work to solve societal challenges. In international teams, cooperation between teachers, researchers, students, and partners is seamless and follows the principles of open science, FAIR data and civil science described above. (European Commission, European Universities Initiative; Laurea University of Applied Sciences, 2021)

To implement and benefit from the objectives and principles described above, several regional and thematic innovation ecosystems have been created in Finland and their websites have made their activities visible and accessible for stakeholders. These ecosystems are mainly publicly funded. The following chapters provide a review of the websites supporting innovations in the social and health care ecosystems. In the conclusions, we reflect on HEIs' possible strategic roles in developing the efficiency and impact of these ecosystems and their national and transnational collaboration.

1.2 OBJECTIVE OF THE REVIEW

The aim of this review is to provide the reader with an overall view of digital innovation platforms that enable multi-stakeholder co-creation and testing of social and health care services. Some platforms that support multi-stakeholder co-creation regardless of the sector are also introduced and examined. An open innovation platform supports different practices of the open innovation process and co-creation (cf. Raunio, Nordling & Saarinen, 2018). As some of the digital platforms in the review define themselves as innovation platforms while others use other terms, in the review, the principal concept used is a website.

The descriptions are based on website texts. The main source is thus the URL address of the website being presented. Although web addresses are not usually included in scientific documents and publications, in this review that has been done, to make it easy for the reader to access the website presented without having to search for the address in the references. Where the text is supplemented by other Internet sources, it is indicated in the text by the usual source reference practice. Websites rarely indicate their publication date. Therefore, 2021 has often been indicated as the publication year, as the sites have been referred to in January 2021.

The next chapter first describes the joint websites of cities, university hospitals, and RDI actors. In this context, RDI actors mainly refer to universities and universities of applied sciences. When services supporting the co-creation and testing of open innovations are linked to the local health and well-being ecosystem, the description is preceded by a brief presentation of the ecosystem in question. These include Oulu Health and Oulu Health Labs as well as Kuopio Health and Kuopio Living Lab. However, with regards to services in the

Tampere region, HealthHUB is described first, as the Tampere Health Technology and Life Sciences Ecosystem website is quite recent and its content limited, at least for the time being. After this, the second chapter describes Health Campus Turku and the TERTTU service, although it is to note that the City of Turku is only part of the Health Campus Turku network indirectly via Turku Science Park Oy. In addition, the second chapter examines the Elsa Testbed of the social and health care district of South Karelia, as well as the forthcoming Future Hospital Innovation Platform in Satakunta.

The third chapter focuses on the description of Health Capital Helsinki, the Clever Health Network coordinated by the HUS (Hospital District of Helsinki and Uusimaa) University Hospital, and the HUS Testbed services. The testbeds and Labs examined in chapters 2 and 3 are mentioned on the website of Business Finland as members of the national testbed network for social welfare and health care (Business Finland 2019), except for the future Satakunta platform.

Chapter 4 describes two websites administered by a HEI that support digital multi-stakeholder cooperation. The product developer's test and support network Tuttu net was created in a joint project between three universities of applied sciences and two cities, focusing on digital services in assisted living. After the end of the project, Metropolia University of Applied Sciences will have the main responsibility for maintaining the website. Another example is the Bazaar platform of the Tampere higher education community, which still seems to be in the Minimum Viable Product stage. Thus, the platform is not finished, but it has been opened so that the development work can continue with the guidance of user feedback. The services provided through this platform are not limited to the social welfare and health care sector.

Chapter 5 describes the innovation platforms of the cities of Helsinki and Espoo. Testbed Helsinki supports service and product development in four areas, including health and well-being. The Make with Espoo innovation platform, on the other hand, serves the development of innovations that promote learning and growth, mainly in learning environments. Chapter 6 presents the Demola platform, which is maintained by Demola Global Oy.

The final chapter of the review discusses the introduced and analysed ecosystem websites mainly from the perspective of the strategic opportunities, offering, and competencies of HEIs. In addition, chapter seven explores some of the content themes related to the ecosystems and platforms that have not been highlighted on the websites included in this review. Appendix 1 contains observations related to the implementation of the websites and contents that are quite often missing from the descriptions.

2. Joint websites of the city, hospital district and RDI actors

2.1 OULU HEALTH AND OULU HEALTH LABS

The Oulu Health website, https://ouluhealth.fi

THE OULU HEALTH website (in English) presents the actors of the local health and well-being ecosystem and the services that support the development and commercialisation of their innovations. The objective of the ecosystem is to reform health care on a global level and thus improve people's well-being. The ecosystem aims to accelerate the implementation of health sector innovations, promote the business of health technology companies, and develop better solutions for the benefit of citizens.

Figure 1. The Oulu Health website, https://ouluhealth.fi

The website presents the following operators: The WelfareLab of the City of Oulu's Well-being Services, the City of Oulu's Business Services or BusinessOulu, the TestLab testing environment of the Oulu University Hospital in the Northern Ostrobothnia Hospital District (OYS), the University of Oulu, the University of Oulu's Centre for Health and Technology (CHT), the University of Oulu's Biocenter, the strategic Medical Research Center Oulu (MRC Oulu) research unit for the University of Oulu and the Northern Ostrobothnia Hospital District, the Oulu University of Applied Sciences (OAMK), VTT Technical Research Centre of Finland and the Biobank Borealis of Northern Finland. In addition, a link to the Issuu publication is available on the actors' presentation page, which includes more than 50 health technology and life science companies.

Ecosystem actors' services include testing and co-creation services, business development services and support services for digital transformation in the health and well-being sector, which are provided by the Digital Health Hub of the University of Oulu's CHT.

The Centre for Health and Technology of the Faculty of Medicine of the University of Oulu coordinates the research, development, and innovation activities of the ecosystem. The testing and co-creation services of ecosystem actors are described in more detail below.

Oulu Health Labs, https://ouluhealth.fi/services/testing-co-creation/

Oulu Health Labs is a co-creation platform that enables cooperation between health and social service providers, RDI operators and businesses. Testing and co-creation services are provided by the Oulu University Hospital's Testlab, the City of Oulu Welfare Lab and the Oulu University of Applied Sciences Simlab.
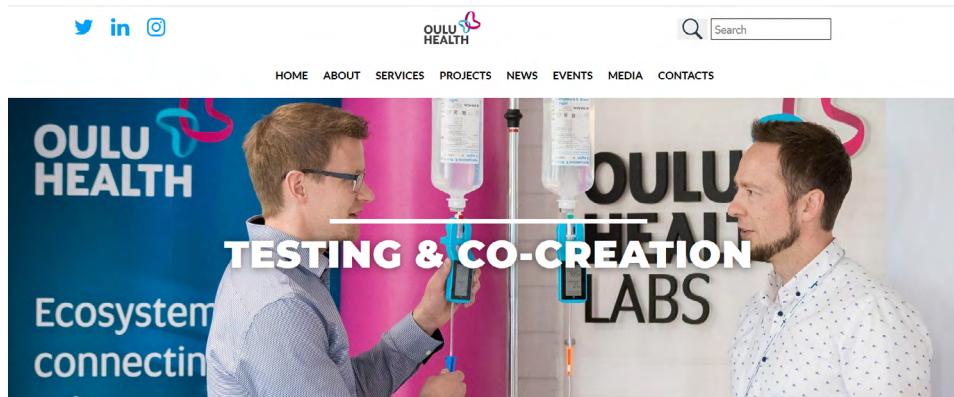

Figure 2. The Oulu Health Labs website, https://ouluhealth.fi/services/testing-co-creation/

The aforementioned actors offer user-centred development and testing services, facilities and equipment to rent, presentations of products and facilities, training and expert services tailored to the needs of companies and other operators.

An operator interested in cooperation fills in a contact form either in Finnish or English that asks for basic information about the company and for a more detailed description of the product, service, or solution to develop or test jointly. The product or service may be at any stage – the options on the form are the concept phase, the prototype phase, the pre-marketing phase, CE marked product or another phase. It shall also be

indicated on the form whether the company has the funding required for the testing and development service. Finally, you will be asked to present the references.

The received contact forms, i.e. preliminary joint development or testing plans drafted by companies, are evaluated once a week. If the contact results in cooperation, a kick-off meeting is held, an implementation plan is drawn up, a contract is signed, users are recruited and the planned testing or development project is implemented jointly. The contact form is shared by the actors, so the applicant company does not need to be familiar with the services of OYS Testlab, Oulu Welfare Lab or OAMK Simlab, as the representatives of these actors jointly assess the contacts.

The TestLab of the Oulu University Hospital, which is part of the Hospital District of Northern Finland, offers a testing environment of 300 square metres, where replicas of different hospital units may be built for testing projects. TestLab also has a digital test environment, a 3D virtual mode and a 5G test network. According to the OYS2030 site, health technology companies may test their products and services in a realistic environment at the OYS TestLab and receive feedback from healthcare professionals. (Testing environment OYS TestLab 2020.)

TestLab's services include the following: Fast Track Feedback, Feedback panel/Prototype end-user trial, Real-like prototype test, Interface IT (data system interface testing), Rent-A-Lab/Launch-In-Lab, 30-Day Trial and Lab Tour. However, more detailed descriptions of these services are not available on the website. There is only the price list in Finnish, in which the above-mentioned services have been described briefly. (OYS TestLab Service Price List 2021.)

WelfareLab for the welfare services of the City of Oulu, on the other hand, is an operating model in which companies and municipal residents jointly produce new social and health care innovations. Even though the description of the WelfareLab operating model mentions municipal residents, social welfare and health care professionals mainly test the products of companies in testing and development projects. According to WelfareLab's presentation text under the City of Oulu's Social and Health Services menu, "customers will participate in testing where possible". The objective of the activities is to place on the market well-designed products that meet the needs of customers. (Oulu WelfareLab 2021.) The objective is probably based on the assumption that professionals are familiar with the needs of customers and are able to provide feedback from the customers' perspective. The WelfareLab on the Oulu Health website also mentions the objective of easier accessibility of better products from the viewpoint of both professionals and residents.

According to the description of the Oulu WelfareLab on the Oulu Health website, cooperation may be based on the needs of either the company or the end user. The WelfareLab description on the City of Oulu's website mentions that the Oulu Health Labs package enables the practical implementation of ideas created at work by social and health care professionals. However, there is no channel on any website where social and health care professionals or end users of the City of Oulu, i.e. Oulu residents, could bring up their needs and development ideas.

Oulu WelfareLab's services include Fast Track Feedback (professionals), Feedback Panel (professionals) and Product Trial, which are available in three different scopes. Depending on the company's testing needs, the latter includes municipal residents, customers, patients or professionals. The service price list for 2017 is available in Finnish on the Oulu Health website via the Oulu WelfareLab Products link. (Oulu WelfareLab service price list 2017.)

Oamk Simlab for the Oulu University of Applied Sciences offers not only testing and development services mainly provided in simulation environments but also training services for corporate staff. Students and expert teachers of the university of applied sciences serve as test subjects. Oamk Simlab Testing and

development services are clearly presented on the Oulu University of Applied Sciences website, only in Finnish. The service offering is divided into four groups: (1) User-oriented development and testing services (idea workshop, prototype testing, the rapid Fast Track expert feedback, showroom and user trial, user-driven research), (2) Premise and tool rentals (simulation facilities and debriefing group facilities, the Enabling Home – an accessible, safe and technologically enhanced home environment, simulation environments for radiography and radiotherapy, facilities for oral health care at Dentopolis, the laboratory and testing facilities for bioanalytics, rehabilitation facilities, optometric facilities and devices, (3) Presentation of simulation facilities (presentation of simulation studios and the Enabling home), (4) Tailored training and expert services for companies and communities. Some service descriptions include an example of services and their price. (Oamk SimLab 2021.)

Although both the University of Oulu and the Oulu University of Applied Sciences are involved in the Oulu Health ecosystem, it seems that only Oamk students are exclusively involved in the implementation of Oamk Simlab's testing and development services.

The Innovation Services section of the Business Oulu website contains a description of the Patiolla.fi platform (2021), which, according to the text, "allows you to participate in and influence the development of services and products" and allows "companies to carry out user-oriented development". The page contains a link to a form which "an ordinary person" should fill in in order to join the Patiolla.fi community. Community members will receive surveys, they are invited to participate in development projects and testing of products and services by companies and other actors, and they are also invited to "workshops, study visits and other pleasant events". Members of communities will decide where and when they wish to participate. Business Oulu experts facilitate corporate projects together with the Patiolla.fi community. Two ongoing and two completed projects have been presented on the website. There is no link to the Patiolla.fi platform on the Oulu Health Labs website.

2.2 KUOPIO HEALTH AND KUOPIO LIVING LAB

Kuopio Health, https://kuopiohealth.fi/en/front-page

Founded in 2019, the Kuopio Health cooperative focuses on promoting competence, research and business in the fields of well-being, food sector and health technology. Its community members include the City of Kuopio, Kuopio University Central Hospital, the University of Eastern Finland, the Savonia University of Applied Sciences, Savon Yrittäjät and the Kuopio Chamber of Commerce. There are 20 corporate members.
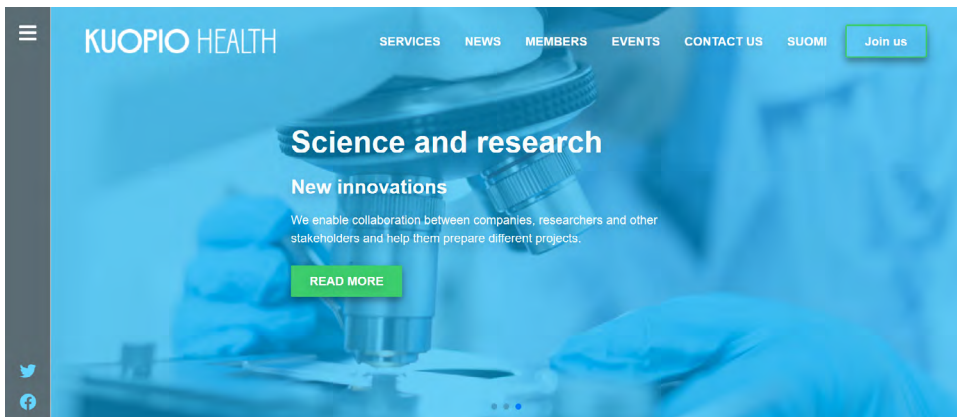
Figure 3. *The Kuopio Health website, https://kuopiohealth.fi/en/front-page*

The services offered by the cooperative include (1) events and workshops, (2) project arrangements, (3) visits and networks, (4) ecosystem marketing, (5) development platforms for multi-stakeholder collaboration and (6) accelerating programs. One service entity is Kuopio Living Lab, jointly organised by three members, which is described in more detail below.

Kuopio Living Lab, https://www.businesskuopio.fi/en/why-kuopio/livinglab/

Kuopio Living Lab offers product development and testing services to health and well-being technology companies. Living Lab is a consortium of three actors: The City of Kuopio, the Kuopio University Hospital in the Hospital District of Northern Savonia and the Savonia University of Applied Sciences. Its services include expert assessments, workshops, usability tests, suitability assessments and development cooperation.
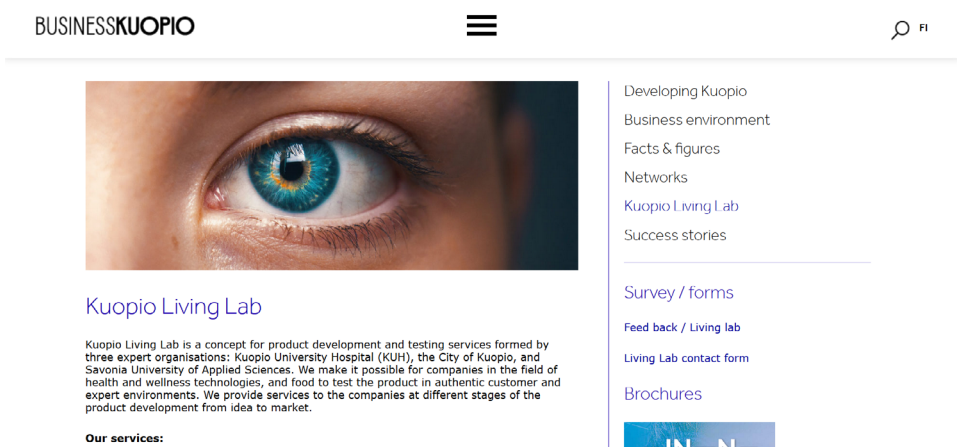

Figure 4. *Kuopio Living Lab, https://www.businesskuopio.fi/en/why-kuopio/livinglab/*

The development and testing environments of the City of Kuopio include social and health services, services for the urban environment, school and learning environments and environments for promoting well-being. The Living Lab of Kuopio University Hospital aims to promote the experimental use of medical devices and solutions at Kuopio University Hospital and to streamline the process. In addition to the joint development and testing of corporate health technology innovations, the KYS Living Lab coordinates scientific clinical device studies. (KYS Living Lab 2021.) The services of the Savonia University of Applied Sciences focus on the initial stages of corporate product development. The services are provided by experts and students of the University of Applied Sciences.

The Kuopio Living Lab page contains a link to a contact form that enables a company interested in cooperation to communicate its product development and testing needs. Living Lab actors familiarise themselves with the forms together, and the company receives an answer within a week. The page also contains a Living Labs feedback form and a checklist for data security and data protection.

Until now, the activities of Kuopio Living Lab have been based on project funding (2 projects, one from 2018 and another from 2019). For this reason, the services have been mainly free of charge for companies. Development and testing services are intended to be subject to a fee from 2022 onwards. (Huusko, Kumpulainen, Miettinen & Wulff 2021.)

On 17 August 2020, the City of Kuopio reported on the expansion of the Living Lab service offering to consumer research in the food sector. The Savonia University of Applied Sciences' applied research unit for the food sector carries out the testing of the innovations of the companies operating in the field among different target groups (Korhonen 2020a).

The news of 14 December 2020 indicates that the Kuopio Living Lab will be merged into the activities of Business Center North Savo. "The aim of the city is to be the most interesting research, development and innovation environment in Europe." (Korhonen 2020b.)

2.3 HEALTHHUB AND TAMPERE HEALTH TECHNOLOGY AND LIFE SCIENCES ECOSYSTEM

HealthHUB (Tampere), https://www.healthhub.fi/

The HealthHUB operations are the responsibility of the Tays RDI-Centre at Tampere University Hospital. The HUB's member organisations include the Pirkanmaa Hospital District (Tays included), the City of Tampere, the University of Tampere, Tampere University of Technology and Tampere University of Applied Sciences. In this respect, the website has not been updated since the merger between the University of Tampere and the Tampere University of Technology. The community also includes health and well-being companies, clinics, researchers, and developers. HealthHUB has a total of more than 50 corporate or other organisation members. You can apply to become a member of the community using the form on the website. Membership is free of charge. Members are required to participate actively in the community. Only members have the right to use HealthHUB workstations free of charge (8 so-called hot desk workstations, for which a separate agreement is required) and a team workspace.

You may also join the site as a follower. Followers may participate in events and discussions and follow the activities of HealthHUB via newsletters.
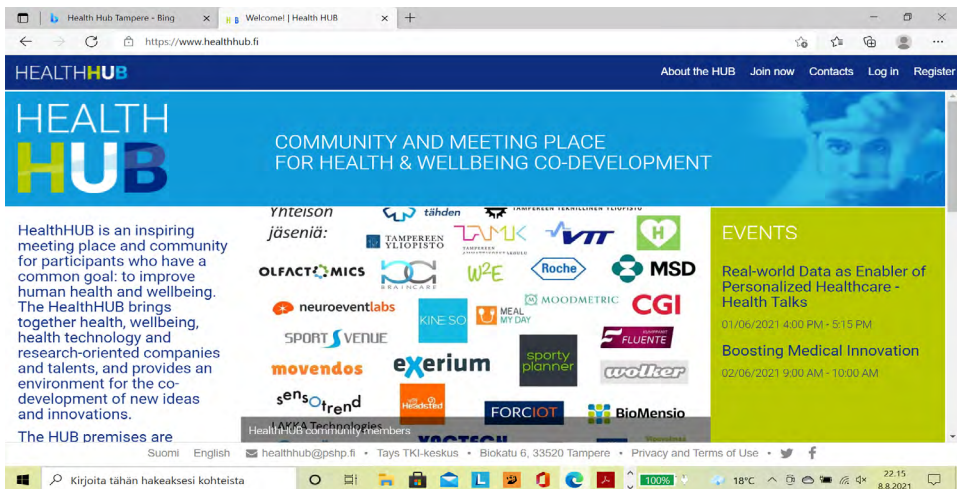
Figure 5. HealthHUB (Tampere), https://www.healthhub.fi/

The HealthHUB website explains that during the first three years of operation, HUB has developed 50 new products, services, or healthcare processes. However, the website does not provide a more detailed message about development or testing services, their processes or pricing.

Tampere Health Technology and Life-Sciences Ecosystem, https://businesstampere.com/business-environment/business-ecosystems/tampere-health-technology-and-life-science-ecosystem/

In spring 2020, Business Tampere, a business and development company in the Tampere urban area, and the Tampere University Hospital launched a new website in English that presents the health technologies and life sciences ecosystem in the Tampere region.

Figure 6. Tampere Health Technology and Life-Sciences Ecosystem, https://businesstampere.com/business-environment/business-ecosystems/tampere-health-technology-and-life-science-ecosystem/

The website can also be found using the keyword Tamperehealth.com. The Business Tampere website presents a total of 15 business and innovation ecosystems. The health technologies and life sciences ecosystem is presented in English as follows: "Tampere Health Technology and Life Science Ecosystem is the regional business ecosystem promoting and enhancing the health of individuals and communities in the Tampere Region". (Business and innovation ecosystems 2021.) When you click on the title of this ecosystem, you will go to a new website in English (long link above), which describes the mission of the ecosystem as follows on its home page: "Our mission is to enhance the health of individuals and communities worldwide".

You can join the ecosystem by completing the contact form. It is promised that those interested in the membership will be contacted within 48 hours. The website contains a list of services offered by Business Tampere to members of the ecosystem (for example, Clinical trial support), but the content of the services or their cost are not described.

2.4 HEALTH CAMPUS TURKU AND TERTTU SERVICE

Health Campus Turku, https://www.healthcampusturku.fi/

The members of the Health Campus Turku network include the Hospital District of Southwest Finland and the Turku University Hospital, the University of Turku, Åbo Akademi, Turku University of Applied Sciences, the Novia University of Applied Sciences (Yrkeshögskola Novia) and Turku Science Park Oy, which is a development company of the Turku subregion coordinating innovation services in the region and is part of the Turku Business Region cluster. City organisations are actively involved in the Oulu Health and Kuopio Health ecosystems presented above; as for the City of Turku, it only participates indirectly in the Health Campus Turku network, for instance in the Board of Directors of Turku Science Park Oy.
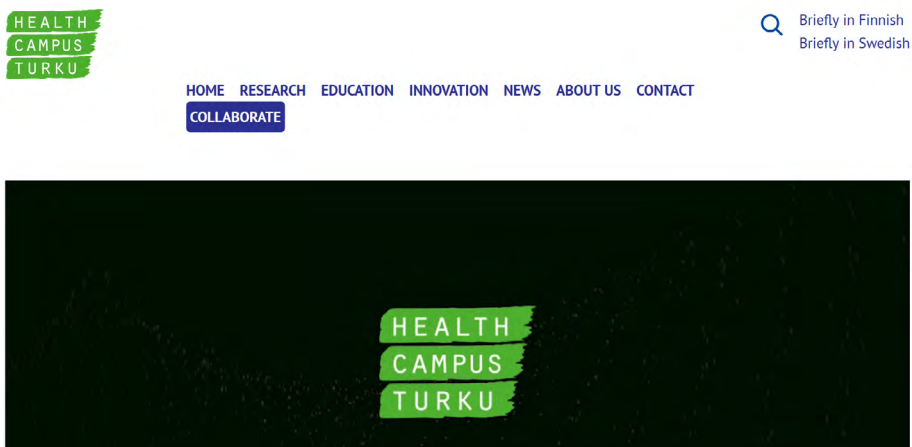

Figure 7. Health Campus Turku, https://www.healthcampusturku.fi/

The Health Campus Turku strategy defines the network's mission, vision and values as follows: "Health Campus Turku is a multidisciplinary health and social sector, biomedicine and health technology ecosystem that develops research, teaching and innovation activities and business activities in the region to promote the health and well-being of the population. The vision is to be an internationally effective and open centre of excellence for health and well-being. Its values include partnership, a goal-oriented approach, capacity for renewal and social responsibility." (Health Campus Turku Strategy, 2020.) The strategy is currently only available in Finnish on the site.

TERTTU Collaboration platform, https://www.healthcampusturku.fi/innovation-new/terttu/

The TERTTU service, which was launched in June 2020, currently (January 2021) only refers to the fact that a company interested in product development and testing cooperation may contact it using a joint form for operators. In addition to the contact details, the contact form contains a single open question on the company's need for development and cooperation. Thus, the company does not need to know in advance what development and testing environments Health Campus Turku has to offer.

The TERTTU service working group assesses the contact form that has been submitted to the system, possibly requests further clarification from the sender and forwards the cooperation initiatives on the Health Campus to a test platform or research group that is willing to jointly develop the proposed solution (Press release 2020). The TERTTU service fact sheet explains that the contacts are assessed according to the assessment criteria. However, these assessment criteria have not been published on the website. The fact sheet emphasises that the contact form is also intended for use by the personnel of the Health Campus partner organisations. (Fact sheet 2020.) The fact sheet video is available in Finnish, and it has no English subtitles.

According to a press release published on 26 November 2020, the TERTTU service provides the opportunity for co-creation with health professionals in the fields of health technology, foodstuffs, diagnostics, pharmaceutical and device development, or service development. The service will be developed in 2019–2021 by the health sector intermediary platform (Terva) project funded by the European Regional Development Fund (ERDF), which "develops an operating model which guarantees a smooth, high-quality and user-oriented process for both the use of the intermediary platform and the activities of organisations providing test platform services" around the TERTTU service or the intermediary platform (Health intermediary platform 2021).

The Testbeds section of the Health Campus Turku website is linked to sites of 20 test platforms. These test platforms are available to companies and other parties in need of development and testing services. Although the Health Campus Turku website is mainly only in English, some of the descriptions of the test platforms are exclusively in Finnish. The TERTTU Service fact sheet explains that each test platform has its own agreements to regulate the relationship between the test service provider and the party requiring it. Contacting the TERTTU service is free of charge. The fee for development and testing services will be decided on a case-by-case basis. In some cases, external funding is applied for to support service provision. (Fact sheet 2020.)

2.5 SOUTH KARELIA ELSA TESTBED

The Elsa Testbed website, http://www.elsatestbed.fi/en/

The ELSA Testbed is a development environment for social welfare and health care in South Karelia. Testbed was built during a project lasting approximately 2.5 years (1 June 2018–31 December 2020). The Elsa project includes the South Karelia Social and Health District Eksote (in the role of a coordinator), the LUT University and LAB University of Applied Sciences. The project conducted experiments with services that are taken home and that support living at home.
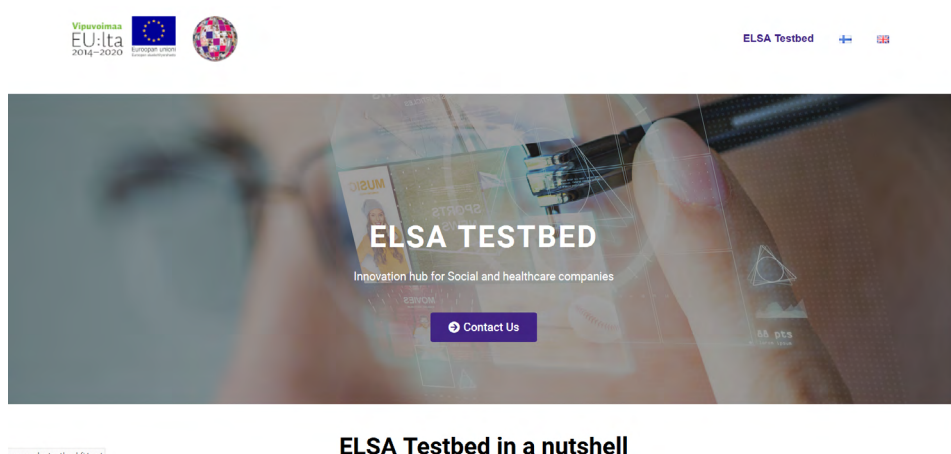
Figure 8. The Elsa Testbed website, http://www.elsatestbed.fi/en/

The processes and operating models related to Testbed, etc. are described only in the Blogs section texts, whose contents cannot be searched. Under the References heading, there are five company logos that provide links to short testing stories or videos. A contact form is available on the website. There is no information on how the activities may continue once the project has been completed. Only the home page has been translated into English.

2.6 FORTHCOMING: SATAKUNTA UNIVERSITY OF APPLIED SCIENCES ROBOAI LABORATORY AND THE SATASAIRAALA FUTURE HOSPITAL AS AN INNOVATION PLATFORM

Hospital of the future, https://www.roboai.fi/en/future-hospital/

SAMK and Satasairaala (Satakunta Central Hospital) are developing the hospital of the future together through research and testing – SAMK – Satakunnan ammattikorkeakoulu

In the three-year (2019–2022) "Future Hospital as an Innovation Platform" project funded by the ERDF, two innovation platforms are developed. One of them is the Satasairaala research and development centre, a simulation space in which health technology can be tested in the most authentic environment possible. In the early stages of the product development process, feedback is received from the hospital staff, and at later stages, the product can be tested in the hospital's clinical functions.

Another innovation platform to be developed in the project is the Auria Clinical Informatics data pool, which contains information on specialised medical care in Satasairaala, the Vaasa Central Hospital and the Turku University Hospital as well as information on the basic health care and private laboratories of individual municipalities. The project will build technology around the pool and provide advisory services for researchers and companies.

According to the project manager, the basic principle of the innovation platform model being developed is that "the challenge will come from the organisation and we will work side by side with it to solve matters" (Valtokivi 2019). SAMK's RoboAI website mentions that the Hospital of the future is part of the national Testbed network. It is not yet available on the Business Finland website.

Data Lake Innovation Testbed for Future Hospital research project, https://www.samk.fi/uutiset/samkilla-lahes-miljoonan-euron-rahoitus-tekoalyn-hyodyntamiseen-laaketieteellisessa-tutkimuksessa/

SAMK's new Data Lake Innovation Testbed for Future Hospital research project, to which the Ministry of Education and Culture granted EUR 575,000 in funding in November 2020, will provide significant support to the Hospital of the future project. In addition, SAMK also funds the project by EUR 325,000. The project will build a test environment for the secondary use of patient and health data. (Wahlman 2020.) The objective is therefore the same as in the project funded by ERDF and SAMK described above.

3. Health Capital Helsinki, CleverHealth and HUS Testbed

Health Capital Helsinki (HCH), https://healthcapitalhelsinki.fi/

HEALTH CAPITAL HELSINKI (HCH) profiles Finland to international experts, companies, and venture capital investors as the world's leading digital innovation ecosystem in the health sector. The HCH website presents in depth the competitive advantages of Finland and the Helsinki Metropolitan Area, such as a stable business environment, a well-trained workforce, access to health data, the digital operating environment and a strong health sector startup ecosystem as well as research-based business incubator and accelerator activities. HCH describes itself as a bridge builder for cooperation between ecosystem operators and as a unifier of RDI projects, investors, and companies. The objective of the website is to attract large international companies and venture capital investors with the promise of finding strategic investment targets for them.
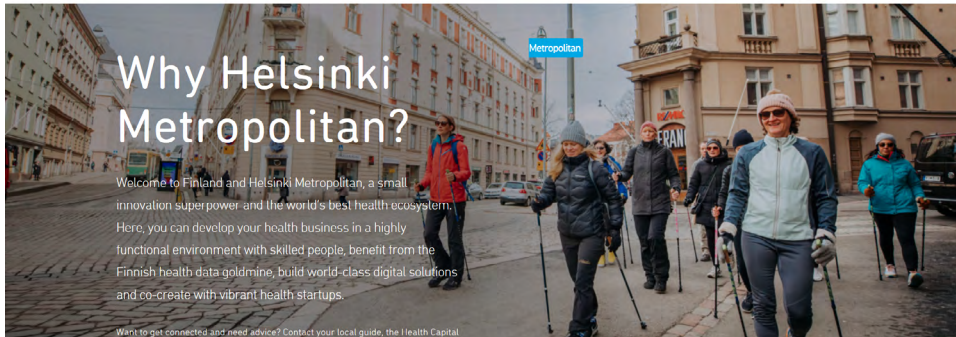
Figure 9. The Health Capital Helsinki website https://healthcapitalhelsinki.fi/why-helsinki-metropolitan/

The HCH website does not explain how HCH works in practice, but it promises to bring together business partners, operators for testbed and living lab services, and world-class clinical research. In addition, the website offers visibility and assistance for commercialising research, launching start-ups, company growth and internationalisation.

According to the website, HCH "receives support from an alliance consisting of the hospitals and educational institutions in Finland's largest cities". The steering group consists of Helsinki, Espoo, HUS, the University of Helsinki, Aalto University, Metropolia, Haaga-Helia and Laurea. In addition, HCH cooperates with Finnish and international organisations, and the website says that if "we cannot provide the service that you need, maybe one of our partners can".

The website provides a convincing image of strong business and health technology through expertise and an ecosystem of national and international scaling through the following logos: Helsinki Business Hub, Health Incubator Helsinki, Upgraded Health Startup Association of Finland, Terkko Health Hub, Business Finland, HealthTech Finland, Saillab MedTech Finland, pharmaceutical industry Pharma Industry Finland, Health Turku, Oulu Health, Kuopio Health, Health Tech Nordic, Health Foundation, ECHAlliance, HIMSS and MedTechBridge.

The HCH website has a lot of news and information on future events related to the operation of the region's ecosystem. The website provides start-ups, companies, organisations, and research groups with information on open application possibilities, challenges, pitching opportunities and hackathon events.

On the website, there is no contact form or contact information for Testbeds or Living Labs. Instead, the contact details of HCH staff are published on the website. The pages do not explain how the process progresses, what is happening and who is cooperated with if the company contacts them and "wishes to test its product in extreme conditions".

CleverHealth Network, https://www.cleverhealth.fi/en/home

The CleverHealth ecosystem is coordinated by Helsinki University Hospital (HUS). The aim of the network is to innovate and take health technology products also into international markets. Member companies of the ecosystem can use the health data of the Helsinki University Hospital and include HUS experts in their development projects. The following companies are members of this ecosystem funded by Business Finland:

HUS (as a coordinator), BCB Medical, BC Platforms, CGI, Elisa, Fujitsu, GE Healthcare, Innofactor, Microsoft, Planmeca, Productivity Leap, Pfizer, Takeda, Roche, TietoEVRY and Varian. The website emphasises the multidisciplinary nature of innovation and the operating model for co-creation. (CleverHealth Network. Tietoa meistä [About us]. 2021.)

Figure 10. The CleverHealth Network website, https://www.cleverhealth.fi/en/home

The News section of the website informs you of news and future events. However, the latter list only contains past events. The Blogs section, on the other hand, contains three blog posts, two from 2019 and one from 2018. However, the latest newsletter was published in May 2021 (describes the situation on 8 June 2021).

The CleverHealth website also has a contact form in which the company can express its interest in participating in the network's activities by describing what kind of expertise it would introduce to the ecosystem, and the company may also propose a new project idea. The site does not explain who processes the forms and how often. The site is fully translated into English, including news and blogs. A link to the HUS Testbed website is only available in a single blog post.

HUS Testbed, https://www.hus.fi/en/about-us/development/corporate-cooperation

HUS Testbed offers companies the opportunity to commission assignments for the needs of the clinical evaluation of the medical devices they have developed. The corporate collaboration process begins by filling in the contact form on the website. (HUS Testbed 2021b.) The confidential contact will be answered within 2–3 weeks. If the proposal progresses from the evaluation phase to the planning phase, the company, the clinic participating in testing and the HUCH Institute will draw up an implementation plan and agree on the permits required for testing. In addition, a cost estimate is made for the project. The service is subject to a fee for companies. The agreement specifies the responsibilities and obligations of the parties, confidentiality and publicity matters and compensation. (The HUS Tested 2021a website was decommissioned in spring 2021, thus no longer available as a source.)

HUS Testbed is part of the Nordic Proof network, whose members include the testing environments of Nordic hospitals and other health sector organisations (Nordic Proof 2021). Introduction to HUS Testbed on the Nordic Proof website: https://www.nordicproof.org/partners/hus/

4. Digital innovation platforms maintained by higher education institutions

4.1 PRODUCT DEVELOPER TEST AND SUPPORT NETWORK TUTTU NET

TUTTU net. Product developer test and support network. https://www.tuttunet.fi/en/front-page.html

THE TUTTU.NET WEBSITE was built during a three-year (2018–2020) project titled HIPPA – well-being and better sheltered housing through digitalisation. The Metropolia University of Applied Sciences served as the project coordinator, and the Oulu University of Applied Sciences, the Tampere University of Applied Sciences, the City of Helsinki, and the City of Oulu served as partial implementers. The logos of these organisations are also included on the Tuttu net website.

The site aims primarily to transmit information and tips on inclusive product development for digital products and services. According to the home page, support will be provided "together with innovation clusters, hubs and testlabs in the fields of social and health care, construction, ICT and business across Finland". The Tuttu net online media editorial board includes representatives of the Metropolia University of Applied Sciences and the Oulu and Tampere University of Applied Sciences.
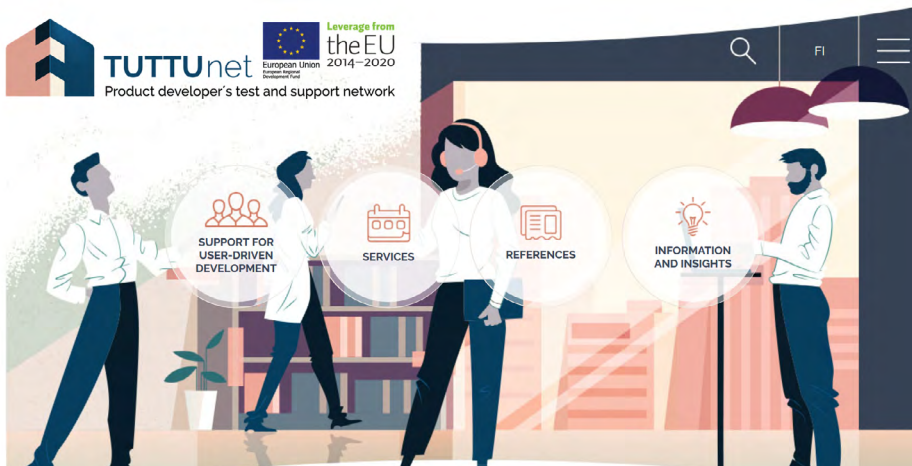
Figure 11. *TUTTU net. Product developer test and support network. https://www.tuttunet.fi/en/front-page. html*

The Support for user-driven development section presents the stages of the co-creation and testing process: (1) Starting the cooperation and permits, (2) Support for co-creation (planning stage), (3) Testing and user trials, (4) Support for commercialisation. Each phase is described in generic text, with many links to the websites of different actors. In addition, there are links to tools that may be used in each stage. For instance, the tools of the first stage (pdf documents) include the Framework of the initial discussion, the template for the Corporate Cooperation Agreement, the General Terms and Conditions for Development, and the Data Protection Statement. There are a total of 26 tools suitable for different stages, i.e. canvas, form, agreement and press release templates. The tools are available only in Finnish.

The Services menu includes services by region (the Helsinki Metropolitan Area, Tampere, and Oulu regions), Virtual tours, and Participate! In the Helsinki Metropolitan Area services, Metropolia's customer-oriented well-being and health services, Health Incubator Helsinki, and Testbed Helsinki are introduced. Virtual tours can be taken to explore test environments and service housing units.

The Participate! section in the Services menu provides three participation options, Challenge, Test and Develop. The first, Challenge, allows the site visitors to communicate their own needs, problems, or challenges by filling out a form. The website promises to collect challenges to improve housing, everyday life, and well-being and to connect the challenge owners with the problem solvers. The challenge owner allows the higher education institution to continue to deal with the challenge. The party presenting the challenge shall indicate on the form where they wish to engage in cooperation. The options are Helsinki, Tampere, Oulu, and remote testing. The site does not explain who will process the submitted forms or how the process may continue. In general, the following information is provided: "We bring together challenges and multidisciplinary experts to discuss different solutions together. We invite experts, entrepreneurs and citizens to discuss the topic publicly on the websites of universities of applied sciences."

The second participation option in the Participate! section is under the title Test. This call to test is not aimed at companies developing services but rather at those interested in the role of a tester. These individuals form a tester pool which, according to the website, is a group that consists "of individuals interested in new technologies, assisted living and developing products and services in the field of social and health care.

Test group members are professionals of the field, customers, family members, representatives of various organisations and other experts and students of different fields across Finland." You can register for the test pool by filling in the form. This form does not include information on what happens after the form is submitted – and when.

The third participation option, Develop, is aimed at actors developing products and services who would like to co-develop or test their product or service ideas with users or who seek new markets for their finished products or services. In addition, there is information on students' innovation projects, in which multidisciplinary student groups solve the challenges of developing products and services. An actor interested in co-creation or testing processes can fill in a form describing the need to develop a product or service. What happens after you click the Submit button remains a secret.

The References section contains the logos of 43 companies or other actors, short presentations, and links to websites with which Tuttu net has cooperated (apparently during the project). Descriptions of the cooperation can be found in the Information and Insights section.

The content of the Information and Insights section consists of articles, podcasts and videos that can be searched by first selecting the information seeker's own role from three options (entrepreneur, expert or student, user) and then selecting topics of personal interest by clicking on the corresponding keywords (co-creation, user-driven design, service housing, testing and user trials, product development, user groups and development needs, commercialisation, future living and entrepreneurship).

There are some inaccuracies in the site help texts and links.

4.2 BAZAAR OPERATED BY THE UNIVERSITY OF TAMPERE AND TAMPERE UNIVERSITY OF APPLIED SCIENCES

The Bazaar website, https://bazaar.tuni.fi/

In September 2019, the Tampere higher education community won the Hacking Higher Education competition with its Bazaar concept (Puntila, 2019). The basic pillars of the concept are continuous learning, research, development, and innovation activities based on cooperation and long-term partnerships. The Bazaar website was launched as a pilot project in spring 2020. In order to read the wider content of the pilot version, it is necessary to register and sign in on the site. In January 2021, the Frequently Asked Questions section tells us that the site is still in the Minimum Viable Product (MVP) stage, i.e. its development is ongoing.

Figure 12. *The Bazaar website, https://bazaar.tuni.fi/*

The main purpose of Bazaar is to enable the formation of platform-based value in the RDI ecosystem and to facilitate cooperation between the Tampere higher education community, the surrounding society and business life (alumni included). Bazaar's offering is aimed at registered users, individuals and organisations representing different fields and sectors who are interested in collaborating in the development of competence and in research, development, and innovation activities. In January 2021, strong authentication is required for signing up and logging in to the Bazaar site.

The offering refers to learning modules, degree programmes, courses, thesis topics, projects, innovation challenges, experts, laboratories of HEIs and other testing environments, as well as opportunities to participate in project application partnerships and externally funded projects, etc. In order for a registered user to report on their offering on the site, they must first obtain the so-called extended rights from the site administrator. Only the offering of the University of Tampere and Tampere University of Applied Sciences (Browse offering section) came up for the site users who registered and logged in in January 2021. Although the website is fully translated into English, the "notifications" that describe the offering are mainly in Finnish. You can search the offering database.

In the Frequently Asked Questions section, the target groups of the offering include the students, alumni, teachers and researchers of the University of Tampere and Tampere University of Applied Sciences as well as all other experts from business life, regardless of whether they have previous contacts with the Tampere higher education community or not. The users registered in January 2021 (Browse people section) mainly include the staff of the Tampere higher education community. You can search the registered users' database.

The website does not inform you when the service is to be ready for wider use.

5. Sites maintained by cities

5.1 TESTBED HELSINKI

The Testbed Helsinki website, https://testbed.helsinki/en/

THE TESTBED HELSINKI website of the City of Helsinki was launched in November 2020. In particular it serves companies and research, development and innovation actors. The purpose of the website is to help these actors find information on the development and experimentation opportunities for products and services in the fields of teaching technology (EdTech), built environment, health and well-being, and smart transport. In these areas, the city, together with other actors, wishes to innovate solutions that provide businesses with business opportunities and promote the well-being of city dwellers. The website has been published in Finnish and English, and there is a single page in Swedish. Development and experimental platform activities are coordinated by the Economic Development Division of the City of Helsinki Executive Office.
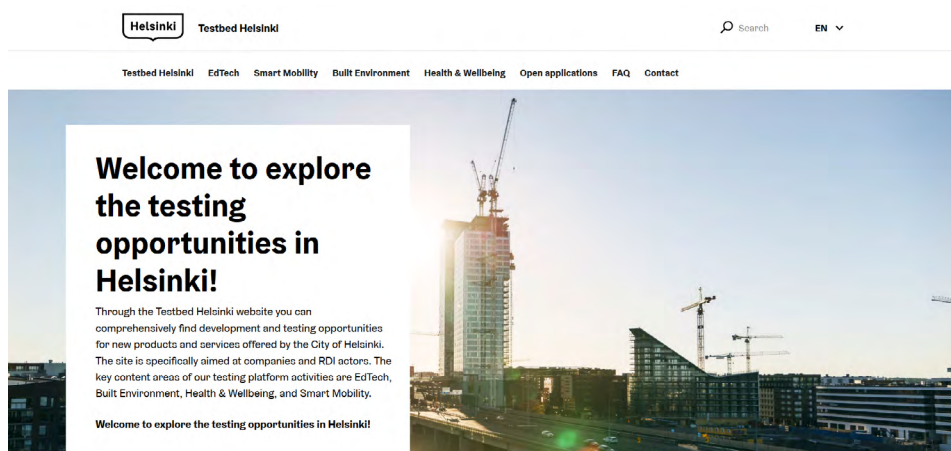
Figure 13. *The Testbed Helsinki website, https://testbed.helsinki/en/*

Companies and RDI actors can participate in development and experimentation processes by two routes: either by participating in the innovation challenges and application rounds opened up by the city or by proposing cooperation with the city itself. According to the Frequently Asked Questions section of the website, "domestic and international companies of different sizes and at different stages of development may apply for experimentation activities". The RDI actors mentioned include universities, universities of applied sciences and research institutes. The innovation challenges opened up by the city of Helsinki and open applications for experimentation are always based on needs identified by the city.

The Open applications section of the Testbed Helsinki website informs you of the invitations to tender for agile pilots. In other words, the agile pilots (tests) will be selected as a call for tenders, and the city will purchase the selected pilots as small procurements. The Open applications section contains the invitation to tender and tender evaluation criteria, a procurement contract example, a data protection appendix and a link to the application form.

Companies and RDI actors can propose to the City of Helsinki an innovation experiment of their own by filling in the Test Proposal form on the website. The form allows the company to express its willingness to cooperate for development and experimentation in any of the four areas mentioned above. Enterprise-oriented projects are free of charge. The actors participating in the experiment are therefore all responsible for their own costs.

It seems that companies in the EdTech sector in particular are enthusiastically invited to participate in enterprise-oriented development and experimentation projects in Helsinki comprehensive schools, upper secondary schools and other learning environments. The target groups of the experiments include learners, teachers, other school staff, staff from other sites, student guardians and city experts. An **Easy Access Co-Development (EAC)** operating model has been developed for co-creation between companies in the sector and the above-mentioned target groups. (EdTech 2020.)

In addition to the EdTech area, business-oriented development and experimentation projects are strongly encouraged to participate in the smart transport theme. Digital solutions and smart services, such as IoT solutions, artificial intelligence, MyData or innovative mobility aids, are at the core of experimental activities in this area. The target groups for the experimentation include urban residents, tourists, other companies, or public sector operators.

As a rule, the intellectual property rights of innovation projects resulting from both innovation challenges and open applications as well as business-oriented innovation projects will remain with the main implementer of the experiment (company, RDI organisation), unless otherwise agreed.

The Helsinki Testbed website presents previously implemented development and experimentation projects using short stories.

5.2 MAKE WITH ESPOO

The Make with Espoo website, https://makewithespoo.espoo.fi/en

The objective of the Make with Espoo website of the City of Espoo is to inspire companies, associations, and city operators to jointly develop products, services and solutions that promote learning and growth in Espoo's learning environments. The website was launched in autumn 2020.
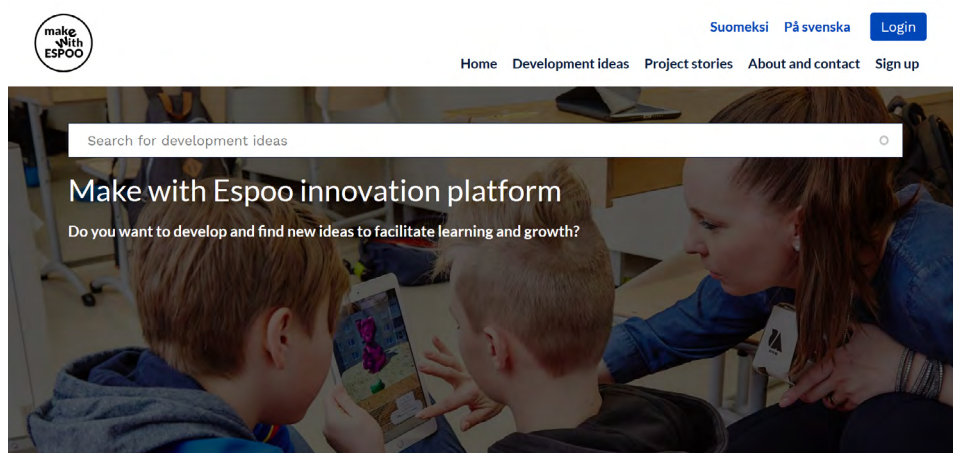

Figure 14. The Make with Espoo website, https://makewithespoo.espoo.fi/en

The Make with Espoo website highlights the principles of open innovation. The purpose of the website is to present development ideas by companies and other actors in the City of Espoo that could be co-developed in establishments for early childhood education and care and pre-primary education establishments, primary and secondary schools, upper secondary schools and other upper secondary education institutions, youth services, libraries, museums or sports and fitness service environments. The website contains an e-form for presenting the development idea. However, you must register with the service to complete this form. The registration form, on the other hand, asks for the business ID of the organisation represented by the individual registering for the service. The basic information of the registered (and logged in) site user is automatically included in the development idea description form.

Once the development idea has been published on the website, the idea is that actors interested in it will contact the author of the idea on their own initiative. For example, if a history teacher at a general upper secondary school has published a development idea, they expect to be contacted by companies or associations that are willing to develop a solution for the teacher's needs. If, on the other hand, the publisher

of the development idea is a company, the company will expect to be contacted by actors of the City of Espoo. However, at the time of writing this publication (20 January 2021), the website contains only two examples of development ideas, i.e. no actual development ideas. It is likely that the pandemic has interrupted corporate cooperation.

Once the author of the development idea and the developer of the new solution interested in the idea have come in contact with one another, the process continues with the preparation of an implementation plan for the development project. Before the actual implementation period begins, a data protection assessment is carried out, and the agreement is signed. An external partner must also accept the principles of the co-creation activities: commitment, flexibility, openness and trust, equity, courage, learning new things and gratuitousness, i.e. money does not change owners (Terms and principles 2020).

In addition to development ideas, the Make with Espoo website presents descriptions of implemented co-creation projects. There are currently (20 January 2021) four stories on the website. Three stories take place in the comprehensive school environment, and one in early childhood education and care – in the latter development project, only teachers participated in the development of the service. Project stories are written by company representatives. Both development ideas and project stories are published only in the language in which they were originally written. Three of the four stories mentioned above are in Finnish and one in English regardless of which language has been selected.

There are a few technical issues with the registration process and invalid or broken links on the site.

6. Demola platform to bring together higher education students and the challenges of organisations

Demola platform, https://www.demola.net/

THE PURPOSE OF the Demola platform is to bring together companies, public sector organisations, non-profit organisations and higher education students at a global level in Demola projects that focus on understanding future trends and changes in consumer behaviour in order to develop new products, services and value creation models. Demola Global Oy from Tampere maintains the Demola platform and operations. The company's turnover was EUR 792,000 in 2019 (Finder 2021). Demola operates in 18 countries.

Figure 15. *Demola platform, https://www.demola.net/*

Companies' or other organisations' collaboration with Demola begins with a workshop, focusing on identifying the company's future challenges, trends affecting the company's business operations and drivers for change. An international multidisciplinary group of students will then be compiled, which will jointly develop solutions to the company's challenge in an 8-week, standardised project facilitated by professionals. Company representatives can participate in a process that combines strategic foresight with design and system thinking and the tools of these three approaches.

According to Demola website, they bring together 50 universities and 750,000 students around the world. Bachelor's degree, master's degree and doctoral degree students submit an application to work on challenges published on the platform. If there are no challenges of interest to the student or if their application period has already passed, the student may submit an open application. Students must prepare for 10–15 hours of weekly work and at least one weekly online meeting. The intellectual property rights of project outputs remain with the student group.

In addition to the open challenges, the website also shows the challenges whose application period has expired. The challenges are divided into six themes: sustainable development, better life and well-being, new technologies, society and culture, future prospects and markets, and disruptive services. Student group outputs are not presented on the website. However, the Stories section contains articles and success stories, most of which are student descriptions of Demola projects which are considered successful.

Although the website and activities are maintained by a private company, the site does not indicate the possible cost of the collaboration to the organisation presenting the challenge, or to students.

7. Reflection from the perspective of higher education institutions

AS ONE OR more Finnish HEIs are active actors on all innovation platforms and ecosystems presented in chapters 2 and 4, this reflection has been written from the point of view of their roles and activities. Observations and questions have been raised based both on what has and has not been published on the reviewed websites, and on what the potential strategic elements are which might create potential future avenues particularly regarding the rapidly evolving expectations towards HEIs and their opportunities in the global knowledge and innovation economy.

In addition to the national and EU-level objectives and principles described in the first chapter, the social impact of higher education institutions is emphasised in the audit model of Finnish HEIs for 2018–2024. The effectiveness of the HEI activities can manifest as "e.g. education, well-being, research that generates new information, active participation in regional development, the renewal of society, or solving global challenges". (Finnish Education Evaluation Centre 2021.) The innovation ecosystems and platforms presented in chapters 2–4 are also a way for HEIs to achieve societal impact and provide key partners with concrete added value in the short and long term. In an ecosystem-based innovation model, it is natural for HEIs to act as a link between scientific knowledge and regional needs.

The Rectors' Conference of Finnish Universities of Applied Sciences Arene (Arene, 2021a) recommends that regional impact and entrepreneurship be placed at the centre of higher education institutions' effectiveness. Arene specifies its recommendation as follows: "In collaboration with other regional actors, HEIs must strengthen their cooperation particularly with new SMEs which have potential for growth. As part of this activity, open innovation environments should be developed, such as boot camps, ACSI[3] development camps that enable a 'cross-pollination' of ideas and atypical encounters." Arene's policy is well in line with the

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3 Aalto Camp for Societal innovation (ACSI)

objectives and measures mentioned in the introduction that support the role of the European Research Area and the challenge based European higher education alliances.

Arene (2021b) also emphasises that the actors in the region must create and share a vision of the desired future in cooperation with the HEIs. The ecosystems of learning and innovation as well as forums and platforms for co-development and co-creation support the strategic management of HEIs and strengthen the effectiveness of the activities.

Based on these views, we will next discuss the following topics and questions that HEIs in particular could consider when participating in the operation of innovation platforms and ecosystems and when developing them: (1) Mission, purpose, goals – and achievements of the operations, (2) values, norms, and ethical principles guiding the operations, (3) competence development, sharing of experiences and lessons learned, (4) open multi-stakeholder co-creation or confidential testing between two actors. Finally, we will discuss RDI funding and the role of higher education institutions in promoting cooperation and the public, private and people partnership (PPPP).

Mission, purpose, goals – and achievements of the operations

Chapters 2–4 above summarise the local ecosystems to which the co-creation and testing services of the actors on the innovation platform are attached. The missions or objectives behind the services on the ecosystem level are highly extensive, for example, the objective of the Oulu region ecosystem is to reform health care on a global level and thus improve people's well-being. The mission of the Tampere ecosystem is to improve the health of individuals and communities worldwide. The vision for the Health Campus Turku is to be an internationally effective and open centre of excellence for health and well-being. Health Capital Helsinki (HCH) combines health technology companies with top research, HUS data pools, and capital markets. The HCH website also refers to itself as a gateway to regional testing environments and the website supports Finland's goal of being the most competent and attractive innovation and experimentation environment in 2030.

However, individual digital innovation platforms that present their co-creation and testing services do not explain how they contribute to the extensive missions of the ecosystems or to achieving the goals or the visions. Therefore, the following questions remain unanswered on their websites: Why, in the first place, do the public sector actors provide co-creation and testing services for companies and researchers? What are the mission, purpose and goals of these activities? Or rather, one can ask: what other objectives are there in addition to supporting the product and service development of companies? And: what is the long-term earning logic and business model of the platforms and ecosystems launched with public project funding, and what are the long-term criteria set for them by the research funding organisations? The extensiveness of the missions is an interesting observation especially considering the fact that the related national policy and funding objectives are relatively explicit.

Most websites provide a contact form for companies interested in co-creation and testing services. The received forms, i.e. preliminary testing plans, are assessed by a group consisting of, for example, representatives of a city's social and health care services, a central university hospital, and HEIs. The website may indicate that the group will use established evaluation criteria to consider which proposals will advance in the process from testing to piloting and procurement. Evaluation criteria are often not published on the website. Consequently, the question arises of what kind of innovations or innovation ideas are wanted for the co-creation process. Will the evaluation emphasise the developed or tested solution's benefits for individuals, the public sector, business life, or public health and the national economy? Will an innovative idea in the early

stages of the product development process with novelty value be favoured, or is there rather a desire to test whether a nearly finished product or service improves the current operating model?

There are also questions arising regarding sharing and collaboration. For example, do regional platforms or HEIs operating on them develop common harmonised testing processes and evaluation criteria that allow for comparison? Alternatively, do they cooperate in using the information and data on the health and well-being of Finnish people that forms the basis of CleverHealth Network's activities? Does cooperation between ecosystems enable the spread and deployment of the tested products from one hospital district or city to another? Or how will testing carried out in Finland help products and companies to succeed in the European internal market or globally?

When higher education institutions participate in the activities of innovation ecosystems, they are engaging in societal interaction with the aim of achieving impact. When examining the content of the websites, the question arises, what will the jointly developed innovations produce: what will change, and – above all – how will the change be monitored, and the impact assessed? HEIs have competence that could be further utilised for developing and evaluating the impact of innovation platforms and innovations created by means of co-creation. In order for the development and evaluation of impact to be meaningful, an impact-oriented vision and clear objectives are required for multi-stakeholder co-creation.

On the websites included in the review, it is difficult to find follow-up information on how many co-creation or testing projects have been implemented during the year or how many companies and other actors have been involved in these projects. There are also few descriptions or information on the results of implemented co-creation and testing projects and the impacts of innovations.

Values, norms, and ethical principles guiding the operations

In Chapter 2 above, the following guiding values were mentioned in connection with the activities of Health Campus Turku: partnership, goal-oriented approach, capacity for renewal, and social responsibility (Health Campus Turku Strategy 2020). Kuopio Health, on the other hand, communicates that it operates using an open innovation ecosystem model. In addition, it is believed in Kuopio that collaboration is a resource that provides a modern platform for new ideas to grow and develop. (Kuopio Health 2021.) Oulu Health Lab explains that it offers user-oriented development and testing services.

Which values, norms, and ethical principles guide the implementation of co-creation and testing services? Is user-centeredness a guideline for the operations? The role of the user may of course be played by a professional or a citizen, a patient or a patient's family member. How are users' needs and their ideas taken into account in the innovation process? Or do users only play the role of feedback providers, or even the role of test objects? The websites do not invite users to play an active role, emphasise their own needs, or brainstorm potential solutions. The websites also do not indicate whether the professionals, residents or patients who participated in the co-creation or testing projects are informed after the project about what happened to the product or service.

Additionally, it is worth noting that all higher education institutions have competence in research ethics. The use and sharing of this competence is likely to be valuable for all stakeholders.

Competence development, sharing of experiences and lessons learned

Higher education institutions are experts both in anticipating competence needs and in learning. It seems that the competence development of the stakeholders in the innovation ecosystem has not been systematically integrated into the activities of innovation platforms. When a HEI provides its partners with chargeable or project-funded services for co-creating or testing of products, services and processes, it could also be examined whether the partner organisations need to reinforce features such as their innovation capabilities, their design thinking capabilities, their competence in customer-centric business logic, or their competence in the procurement of innovations. The integration of continuous learning services provides a great opportunity to reinforce the impact of innovation ecosystems and, at the same time, the societal impact of HEIs.

One of the most important tasks of an orchestrator of innovation ecosystems or networks is to manage the knowledge mobility, which refers to the sharing, acquisition, and use of knowledge (Dhanaraj & Parkhe 2006). Orchestrators are expected to organise events where companies that are part of the network share both explicit and implicit information with each other and learn new things together (Gausdal & Nilsen 2011). This is what the leaders of the ecosystems presented in this review do, and the websites describe their different events. However, it seems that lessons and experiences on specifically the co-creation and testing processes are not systematically shared, at least not on the websites. In addition to competence development capabilities, HEIs also have competence in planning and implementing different learning environments or platforms, which is needed in open innovation ecosystems.

Open multi-stakeholder co-creation or confidential testing between two actors?

As mentioned above, Arene (2021a) recommends that higher education institutions develop open innovation environments that "enable the cross-pollination of ideas and atypical encounters". To what extent are the innovation platforms described in this review open? Few websites have shared stories about the co-creation and testing processes of implemented projects.

The descriptions of innovation platforms give the impression that the activities are carried out as illustrated in Figure 15. In the figure, C1-C8 are companies that send a contact form via the website (or participate in a specific innovation challenge or agile piloting search, for example). P1-P4 are organisations providing co-creation and testing services and an authentic development and testing environment.
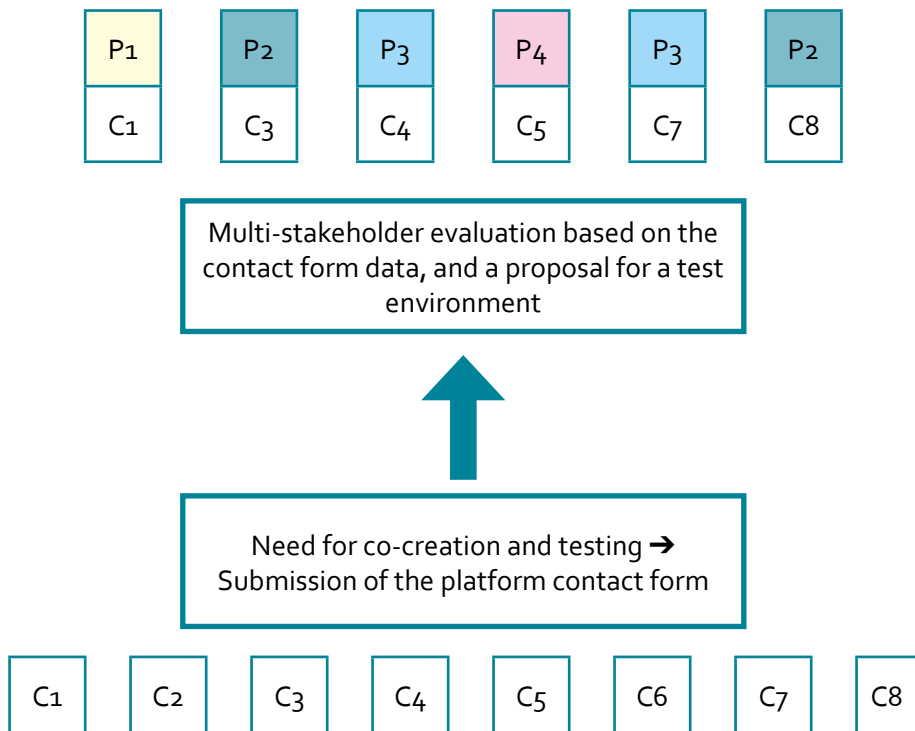
Figure 16. Innovation platform administered by several operators – will it boost multi-stakeholder co-creation?

The innovation platform serves as a gatekeeper, as the group of providers of co-creation and testing services usually decides which contacts lead to cooperation and which do not. In the figure, C_2 and C_6 do not pass through the gateway. Taking the needs of the company into account, the provider group decides which organisation (P_1-P_4) plans and implements a co-creation or testing project with the company. This usually leads to cooperation between two operators (e.g. C_7 and P_3), where "cross-pollination and atypical encounters" occur exclusively between representatives of these operators' organisations, users included. The lessons and experiences of cooperation between C_7 and P_3 are apparently not shared beyond these actors if the innovation platform does not require the project to be shared as a story or a video on the platform website.

Assuming that the service provider P_1 in Figure 16 above is a higher education institution, its experts and students will only be involved in the C_1 project. However, the staff and students of higher education institutions would certainly also have plenty to offer and learn in co-creation and testing projects where the HEI itself does not offer the authentic development or testing environment.

The strategic role of higher education institutions supported by policy and funding schemes in promoting nationwide and Pan-European cooperation

In this subchapter, we will discuss the potential and preconditions in increasing the HEIs' strategic role in developing a competitive and attractive nationwide network of health and wellbeing innovation platforms that is well connected and positioned within the European and global ecosystems.

As explained in the first chapter, the vision of the National Research and Innovation Council is that Finland as a country will be the most competent and attractive innovation and experimentation environment by 2030. Based on the information provided by the reviewed websites, the first observation is that several different types of competent but scattered innovation and experimentation environments have emerged across the country. As previously emphasised, the second observation is that Finnish HEIs are commonly involved in the activities of the social and health care ecosystems and platforms. Nevertheless, based on the available information, it remains unclear whether Finland as a country has become more "competent and attractive" as an innovation and experimentation environment or if this objective, in general, has been actively promoted. Based on our previous experiences from Pan-European collaboration among multi-stakeholder innovation ecosystems, we raise the following questions and potential avenues and ideas on what might be done to support these bottom-up activities.

The limited publicly available information indicates that the introduced innovation platforms and ecosystems contribute well to both the national and European objectives and principles. Hence, our first question/idea is related to international funding. The until now mainly nationally funded platforms, if following the principles of European Research Area, European Industrial Strategy, and the European Universities Initiative, would surely benefit from international collaboration and funding. In particular, the Innovative Actions (IA) and the Support and Coordination Actions (SCAs)[4] of the European Union framework programme would provide the reviewed ecosystems with access to EU funding and Pan-European collaboration to co-create, test, pilot, demonstrate, validate, or deploy solutions in RDI projects. Thus, also for the HEIs, multinational collaboration would be an excellent way of increasing the acquisition of competitive funding to improve both scientific excellence and societal impact. Moreover, if wisely used, the EC initiatives and funding in conjunction with the Pan-European distributed Knowledge Infrastructures (KIs) and Technology Infrastructures (TIs)[5] would leverage joint innovation and support market creation and innovation deployment in the spirit of the European Single Market.

As the aim is to develop the country (as an attractive and competitive innovation environment), one would expect harmonisation of the used methods and protocols, and greater strategic cooperation and overall orchestration of all local and regional platforms and innovation environments in Finland. With the European University Initiative and the Vitalise project, funded by the EC, the Pan-European strategic international cooperation and its harmonization and active orchestration have already been incorporated in the operation of various ecosystems. Therefore, the question arises as to whether also the national funding providers (the RFOs and national government) should encourage the HEIs to collectively raise their strategic profile. Inherently, most of the higher education institutions already have the needed competence to coordinate and orchestrate innovation activities among multiple stakeholders, which according to an impact study

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4 For more information on funding instruments and related activities read https://webgate.ec.europa.eu/funding-tenders-opportunities/pages/viewpage.act Accessed on 14 September 2021.
5 [According to Apostalia Karamali (Head of Unit, DG RTD) the TIs play a crucial role at local, regional, national, and European levels implementing synergies with the European Industrial Strategy (EIS) and the European Research Area (ERA). Dr Karamalia spoke during the Open Living Lab Days 2021 https://openlivinglabdays.com/ll-as-technology-infrastructures/ Accessed on 14 September 2021.

commissioned by Business Finland (Zegel et al. 2020) are urgently needed in the Finnish growth ecosystems supported by the national government.

Moreover, one should ask whether in addition to the provided co-creation and testing services, also the scientific knowledge of Finnish HEIs should be emphasised as the strategic core of national and international cooperation. The nationwide strategic role of HEIs could be enhanced for example by following the European University Initiative and the international university alliances orchestrating thousands of associated partners, i.e. companies, cities, NGOs, and CSOs operating in various parts of Europe and across the world. It can be assumed that from the perspective of international stakeholders, strategic collaboration between the local and regional ecosystems could substantially improve the quality and effectiveness of the Finnish system. Furthermore, coordinated collaboration could increase the international visibility and accessibility of Finland as an innovation environment.

As the competition on resources is getting fiercer, collaboration among the national and Pan-European ecosystems would also provide visibility and a channel for HEIs to sell their research, testing, validation, and other support services to Finnish and international companies. For students and future professionals, participating in scientific projects and the coordination, orchestration, and harmonised testing services provided by HEIs would additionally provide an excellent learning environment. One would expect a significant improvement to job creation, tax revenues, and the overall societal development to follow the above-mentioned coordinated activities.

As one would expect, strategic bottom-up cooperation, methodological harmonisation, and innovation ecosystem orchestration would however call for top-down support in the form of incentives and funding or critical amendments in HEIs' and project funding's impact assessment criterion.

In conclusion, apart from the above-mentioned insights and ideas, it is self-evident that the national higher education institutions and their science in conjunction with participatory RDI activities could play a significantly stronger strategic role in connecting regional and Pan-European innovation platforms and their ecosystem stakeholders. Hence, as stressed by Vanessa Debiais-Sainton, the HEIs[6] are in a key position to help Europe with its high ambitions: boosting its economic competitiveness and prosperity while the global competition is fierce, achieving the twin green and digital transition, and building Europe's resilience and technology sovereignty in key global value chains to meet the needs of EU citizens.

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6 Vanessa Debiais-Sainton, Head of the Unit in charge of Higher Education policies and programme at the European Commission's Directorate-General for Education, Youth, Sport and Culture explains the role of higher education institutions in societal transformations during the Digital Living Lab Days, September 2021. https://www.youtube.com/watch?v=F5mLZZYyzT0 Accessed on 14 September 2021.

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Appendix 1

OBSERVATIONS ON IMPLEMENTATION: WHAT IS MISSING?

- Since the websites presenting the co-creation and testing services are not dated, it is difficult to know, for example, whether the texts on linked sites, i.e. the webpages of ecosystem actors are written at approximately the same time. Even news articles might be missing the date of publication.
- Because the websites and linked pages are not dated, it is impossible to know which page is the most recent. In some cases, the information on the same subject is different on the linked site.
- Language versions are very varied. Some sites may be exclusively in English, but sites or documents in Finnish are still linked to them. Finnish websites, on the other hand, have rarely been fully translated into English (or Swedish). It seems that when translating the website texts, the services of a professional translator who is also a native speaker of the target language have not been used.
- Some sites are not very user-friendly in terms of navigation. Has site usability been tested before the site was published?
- It appears that links on the websites are not reviewed at regular intervals, as they sometimes lead to unexpected websites.

OBSERVATIONS ON SITE CONTENT: WHAT IS MISSING?

- On some websites, the contact form may only be filled in one section at a time. In this case, you will not be able to immediately view all the questions on the form; there is not e.g. a PDF version of the contact form available on the website.
- Many websites do not reveal what happens to the form once it has been submitted. In other words, information is not provided on who reads the contact forms and how often, or who contacts the sender of the form.
- If the team processing contact forms has established evaluation criteria for evaluating co-creation and testing ideas, they are not published on the website.
- The cooperation agreement template, and practices and contract templates related to features such as data protection are only available on a few websites.
- Only some of the websites provide clear and up-to-date information on the pricing of co-creation and testing services.
- Few websites explain what is usually agreed on in terms of intellectual property rights.
- Only a few websites have shared co-creation and testing services in the form of stories – from the perspectives of different operators.
- There are few descriptions or information on the results of implemented co-creation and testing projects.
- Data monitoring the number of co-creation or testing projects implemented during the year or the number of companies involved in these projects is also very limited.

NUMEROUS PUBLICLY FUNDED regional and thematic innovation platforms and ecosystems have emerged in Finland. Multi-stakeholder innovation is not a new phenomenon, as its development and research began at the initiative of the OECD as early as the 1970s. In the 2020s, however, with global challenges and intensifying competition, multi-stakeholder and participatory research and innovation has experienced a new emergence.

THIS PUBLICATION PROVIDES the reader with an overview of Finnish social and health care ecosystems' websites that enable the multi-stakeholder co-creation and testing of social and health services. There are also a few platforms included that serve multi-stakeholder development regardless of industry. At the end of the review, digital innovation platforms and ecosystems are discussed mainly from the perspective of higher education institutions.

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