

# **Public Health Care Innovation Lab Tackling the Barriers of Public Sector Innovation**

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## **Public Health Care Innovation Lab Tackling the Barriers of Public Sector Innovation**

Acknowledging the public sector's remarkable innovation potential and several challenges hindering its innovation capability, this case study explores the impact of public sector innovation laboratory on innovation barriers of public health care. Findings are based on a Finnish hospital district's innovation laboratory specialised as an authentic environment to develop novel technology and service solutions with various private sector partners. By altering the PSO's approaches on interaction, commercialisation, mutual learning and independence, the PSI laboratory proves especially influential in tackling innovation barriers related to complexity and organisational competences. Conversely, the lab's impact on the barriers of risk-aversion and bureaucracy is lesser.

Keywords: public sector innovation laboratory; innovation barriers; public-private innovation; collaborative innovation; health care innovation

## **Introduction**

The importance of public sector spending tends to increase as the consequence of market shocks such as the COVID-19 crisis. As governments, municipalities and health care systems grow in debt, ever essential is the efficient use of taxpayer money. Where saving-related issues such as efficiently organised services, methods of outsourcing and public procurement often lead the public debate, also innovations are increasingly expected across different public sector domains. Simultaneously, some common barriers for innovation are repeated in discussion, including public sector's heavy regulation and bureaucracy, risk-averse nature of both public organisations and individuals working in them, scattered objectives by different stakeholders as well as short-term motives in the decision-making by elected councillors (Cinar, Trott, and Simms 2019). Although some truth seems to lie in each of these barriers, innovations do not only take place in the public sector but are often proved more radical than the ones originating from the private sector alone (Mazzucato 2011).

A general juxtaposition for public sector's innovativeness exists between public organisations' remarkable financial potential for development and restrictions caused by complexity. Issues stemming from the pluralistic environment are especially eminent in public health care selected as the context for the present study. In addition to performance measures in efficiency, productivity and effectiveness, public health care needs to acknowledge ideological and social considerations attached to its services and innovative solutions developed (Cucciniello and Nasi 2014). Despite of the growing number of new facilitating mechanisms to promote and embed innovation in health care systems on local and national levels, health care innovations tend to proceed at a relatively slow rate resulting in shortages and variation in service outcomes (Williams 2011).

Breaking the innovation deadlocks calls for new agenda that turns innovation into a fixed activity that systematically spreads across different levels of the public sector from local institutions and municipalities to international governance structures (Torfing 2013). A key source of innovation thus lies in modern public innovation policies that advance multi-actor collaboration in myriad forms of networks, partnerships and interactive arenas (Kattel, Lember, and Tõnurist 2020; Bommert 2010; Hartley, Sørensen, and Torfing 2013). By opening a health care organisation's service production to different forms of collaboration with the competitive private markets, the formed partnerships might for instance pursue new innovative strategies bringing positive consequences for public health goals as well as create new mechanisms for addressing health care's grand problems by leveraging the partners' different ideas, resources, and expertise (Reich 2002).

A timely debate offering a public sector specific view on how multi-actor collaboration can contribute and enhance public sector innovation relates to the concept of collaborative innovation (Crosby, Hart, and Torfing 2017; Bommert 2010; Hartley et al. 2013). Connecting findings on collaborative governance (Ansell and Gash 2008) with modern innovation theories, collaborative innovation deserts the private sector inspired idea of innovation stimulated from the heroism of exceptional individuals (Torfing 2019) and instead focuses on governance networks as collaborative arenas answering to problems which social and political actors alone would be unable to solve (Torfing 2013). Yet, where PPPs and other collaborative innovation policies are increasingly used to solve public health issues and challenges, awareness on their actual effectiveness, efficiency and convenience is lacking (Torchia, Calabrò, and Morner 2015; Torfing 2019). By exploring a case of a public health care innovation laboratory, the purpose of the present

study is to add understanding on collaborative policies' impact on public sector innovation barriers.

The study's qualitative data concerns a health care innovation laboratory established and operated by a Finnish public hospital district since 2015. Public sector innovation laboratories (i.e. PSI labs) are one of the specific methods of public sector organisations (PSOs) creating "islands of experimentation" where both the PSOs and private developers can test and scale out public service innovations involving a multitude of stakeholders in the innovation process (Tönurist, Kattel, and Lember 2017; McGann, Blomkamp, and Lewis 2018). In addition to collaboration with a sample of 12 companies, the relationships within the hospital district's other intra- and interorganisational networks are explored. Accordingly, the present study explores the following two research questions; First, *what are the key barriers of innovation in public health care environment?* Second, *how are the innovation barriers remedied by a public health care innovation lab?*

Contributions of the study add knowledge to the debates related to public sector innovation laboratories and innovation processes in public health care environment. Managerially, the study's objective is to support especially public organisations in either setting up similar PSI labs or other collaborative innovation policies. The former lies in contrast to guiding the developing private companies, where innovation partnerships with public sector often show rather similar to their existing collaboration with private sector counterparts (Uyarra et al. 2014).

This study is structured as follows. First, the barriers of public sector innovation in relevant public management literature are presented and categorized with specific emphasis given on barriers related to public health care context. Next, a description of PSI labs in general, the lab under study and the exploratory case method applied are

presented. Third, key findings on the innovation barriers and remedies to overcome them in our case data are illustrated. Finally, the study's implications on relevant public sector innovation debates, study's limitations and avenues for future research are discussed.

### **Background on public sector innovation barriers**

Whereas innovation has been considered a key driver for growth and prosperity in the private sector for ages, the younger debate of public innovation still suffers from various contradictions. While public sector's innovation potential in resources and competences is widely acknowledged, many public policies have not advanced a knowledge society in the best manner (Aho et al. 2006). Overwhelming fences for public innovation are observed by policy-makers and practitioners sometimes in the predominance of strict hierarchical control and red tape, sometimes in the lack of competition and motivating economic incentives (Torfing 2019). While new public management movement has offered partnerships with private sector as the core resolution to these barriers, also this discussion carries false beliefs about the blisses of private R&D, superior agility by SME's and venture capital reaching solutions to public sector challenges in the best manner (Mazzucato 2011).

A barrier approach to innovation is not new (Hadjimanolis 2003) and rather well-established also within the sphere of public sector innovation (Cinar et al. 2019). Public innovation barriers have been categorised over the years for instance to internal versus external (Bloch and Bugge 2013) and revealed versus deterring barriers (D'Este et al. 2012). Yet some of the recent studies consider these frameworks to neglect the multifaceted environment of public innovation (Cinar et al. 2019). Although technological innovation has taken a predominant role in the transformation of public health care (Cucciniello et al. 2015), it often proves challenging to separate the

technological innovation from the service delivered. Health care innovation also takes place in a multidirectional and iterative fashion, sometimes preventing predicting the effects of new policies and practices and frustrating public practitioners seeking for informed recommendations to improve their innovation readiness (Williams 2011). Exploration of former studies on public sector's general and health care specific innovation barriers lead us to arrange the common barriers into four broader groups applied later as the basis for our case analysis. Accordingly, the issues hampering public innovation are discussed next divided into categories of *complexity*, *risk-aversion*, (lack of) *competences & resources* and *bureaucracy*.

### ***Complexity***

Although multi-actor interaction is proven to enhance public sector innovation, the coordination of dialogue between public organisations, contractors, citizen groups, NGOs, political entities and international institutions is not clear-cut (Hartley et al. 2013). Challenges caused by the plurality of actors are particularly true for health care sector (Cucciniello et al. 2015). The complexity caused by different social identities and institutional cultures leads to shortages in knowledge sharing, communication and effective network governance as well as lack of involvement and accountability from essential actors (Cinar et al. 2019). Even seemingly undivided public sector organisations do not often act in a coherent manner in practice (Caldwell et al. 2005). In addition to various types of innovation (Cucciniello and Nasi 2014), the organisational rationales for health care innovation are various, including improvements in productivity and efficiency, reduced costs, improved quality and responsiveness, reduced service variation and better access to the provided services (Williams 2011).

Many public sector domains contain strong professional identities throughout managers and service implementing public servants (Torfing 2013). Accordingly, individuals tend to negotiate according to their own interest and ignore the common goals, visions and decisions creating shared understanding crucial for successful innovations (Van Buuren and Loorbach 2009). When innovation as a strategic resource with organisational objectives is not understood, health care professionals' non-converging interests lead to differences in expectations and contributions related to the innovation process and differences in innovation's adoption and impact (Williams 2011). Furthermore, where a private business can choose their customers and serve them individually, public service provider is obligated to serve multiple, often conflicting and overlapping objectives and interact even with service users coerced to collaborate in the innovation process (Alford 2014).

### ***Risk-aversion***

Based on pressures related to for instance negative media attention and political consequences, the risk-averse culture has been traditionally seen as a key hindrance in the adoption of novel innovation policies in the public sector (Borins 2001). On an individual level, public servants' and decision-makers' motives for risk avoidance can include conflicting convictions on good public policy, stereotyping of potential innovation partners as unsuitable, false framing of situations, over-reliance on existing resources or needs to cover up other strategies (Cinar et al. 2019). Although the links between public innovation and risk management call for further studies in multiple domains (Brown and Osborne 2013), cultural changes overcoming the risk-averse nature of public organisations are surely required for more collaborative modes of governance (Termeer 2009).



Risk-aversion often displays as a concern of greater cost-efficiency by public organisations. Cost focus marginalises discussion on the content and quality of public service, which on contrary tend to be primary concerns of the service level public employees, private shareholders as well as service users involved (Torfing 2013). In health care, the high level of autonomy, hierarchy and tribal behaviour by physicians leads them to rely on existing work processes and solutions, thus causing problems in the implementation of complex innovations (Prgomet, Georgiou, and Westbrook 2009; Cucciniello and Nasi 2014). Furthermore, risk-aversion towards health care innovations might be caused by the competing goals of health care reform such as efficiency, equity and coverage (Williams 2011). Risk-averse culture shows also as a challenge of incompatibility, where the PSO's culture and norms do not match with the innovative policy applied (Cinar et al. 2019). Resistance and lack of support from individuals grow especially in situations where radically new organisational conditions are adopted (Plotnikof 2015).

### ***Competences & resources***

Innovation barriers related to the shortage of competences and resources illustrate as poor management of the innovation process, lack of suited talent and assets as well as gaps in PSO's expertise (Cinar et al. 2019; Agolla and Van Lill 2016). These barriers manifest as inadequate training (Abuya et al. 2012), unsustainable human workloads (Piening 2011), high staff turnover rates (Gardner et al. 2010) and shortages in money, time or ICT infrastructure (De Vries, Bekkers, and Tummers 2016; Amann and Essig 2015). Innovations require a range of resources from health care organisations to cover both the set-up costs for new innovative practices as well as the needed human resources and support moved from other tasks to innovation processes. Accordingly, where new

innovative structures and culture in public health care are pursued, they need to be balanced against the PSO's contextual requirement to ensure minimum quality of services and safety standards (Williams 2011).

Although the barrier often lies in PSO's insufficient understanding of the market environment and lack of knowledge in reaching the right partners (Bakici, Almirall, and Wareham 2013), room for development exists also in utilising existing resources. Bigger the organisation, more slack is caused due to ineffective cross-fertilisation of people's ideas and competences (Walker 2006). Sometimes, a competence barrier appears in private sector's inability to deliver their solution as planned (Pelkonen and Valovirta 2015) despite a functional innovation policy applied. Similarly, problems related to collaboration between public and private actors might relate to lack of competences in tendering and contracting of innovative procurement practices (Uyarra et al. 2014). Furthermore, a cutthroat competitive spirit might hamper the development of mutual trust and knowledge sharing necessary for collaborative innovation policy to succeed (Torfing 2013).

### ***Bureaucracy***

Finally, a key contextual barrier for public sector innovation lies in high level of formalisation in the form of procedural rules, laws, regulations and hierarchical command systems (Cinar et al. 2019; Valovirta 2015). The bureaucratic silos of public decision-making lead to slowness in adapting innovative solutions and lack of leadership in adopting innovative policies (Hansson, Øvretveit, and Brommels 2012). Public sector's strong demand for standardisation, documentation and performance measurement might push public agencies to draw innovative solutions not fitting the existing measures and eventually getting penalised for innovation (Torfing 2013). Regulatory barrier can also

relate to the extent which public agencies are allowed to interact with citizens using the innovative solutions (Mergel 2018).

In public health care systems, bureaucratic barriers affecting innovation policies take place in local, national as well as international levels and relate to, for instance, patient safety, privacy protection, intellectual property rights and insurance regulation (Keskimäki et al. 2019; Eisenberg and Price 2017). Guaranteeing the quality of care as a commanding principle for health care providers is often ruled in the national legislation such as Finnish Health Care Act (1326/2010). Already the immense size of many health care institutions such as NHS creates bureaucracy that may limit risk-taking and collaboration required for innovation (Cucciniello et al. 2015). A debated bureaucratic barrier exists also in regulation related to public procurement where criticisms towards the rigidity of European Commission (2004/18/EC) and subsequent European Union (2014/24/EU) directives have been numerous (Edquist and Zabala-Iturriagoitia 2012; Georghiou et al. 2014).

Although public innovation literature at large recognizes the crucial role of politicians (Osborne and Brown 2013), just making the distinction between administrative and political actors might prove complicated. First, contradictory messages are possible due to different role perceptions of individual managers where some public managers see themselves as strict guardians of norms and rules and others as brave policy entrepreneurs (Torfing 2013). Second, political barriers for public innovation can relate to lack of support from elected politicians as well as delays caused by the rigorous decision-making processes (Cinar et al. 2019).

## **Public sector innovation laboratories**

Most of the latter innovation barriers are acknowledged in the public sector's transition to a more collaborative innovation environment and shift towards new public governance as the third wave of public administration reform. Where traditional public administration's political control and new public management's intraorganisational focus lack in understanding the fragmented and interorganisational nature of modern public services (Osborne, Radnor, and Nasi 2013), collaborative governance based measures take place in varied forms of creative learning, cross-fertilisation of ideas, coordinated implementation and dissemination of innovations and joint ownership of innovative solutions (Torfing 2013). Tackling the negative assumptions set above, the reality of public sector is far more dynamic and innovative than its general reputation (Mazzucato 2011; Osborne and Brown 2013; Torfing 2019).

Health care systems have illustrated growing interest especially in embracing particular models of open innovation to support change (Fascia and Brodie 2017). First, successful health care innovation policies require thorough understanding of the existing context as in infrastructure, skills, relationships, practices as well as potential obstacles of the PSO (Williams 2011). Second, valid performance measurement and impact assessment illustrating the innovation's contribution to service's efficiency, patient- and other stakeholder satisfaction and overall performance of the health care system, is challenging in health care context (Cucciniello and Nasi 2014). Although most of the modern public innovation policies tend to emphasise the use of networks for identifying relevant ideas and inclusion of service users in co-production of care, no single intervention can ensure innovation in the necessarily complex health care context (Williams 2011).

Enabling more experimental and user-focused approaches for solving public problems, increasingly collaborative organisational arrangements such as public sector innovation laboratories have gained growing attention from both public policy-makers and public administration scholars (McGann, Wells, and Blomkamp 2021). Acknowledging the complexity met by public organisations, PSI labs allow heterogeneous teams of actors to discover and analyse problems from different angles and develop, test and improve prototypes for their practical application (Tönurist et al. 2017). The turn towards PSI labs is especially tied to growing interests in evidence-based policymaking, use of design thinking, and ICT-enabled service production in the form of citizen co-creation, co-production and co-design concepts (McGann et al. 2018; Tönurist et al. 2017).

The labelling of public sector innovation laboratories has been multifaceted (McGann et al. 2018) and overlapping terms include i-labs (Tönurist et al. 2017), public policy labs (Fuller and Lochard 2016), innovation teams (Puttick 2014) and social innovation labs (Kieboom 2014). Unifying characteristics for most innovation labs include high level of organisational autonomy, capacity to function across policy sectors and labs' status as change agents (McGann et al. 2021; Schuurman and Tönurist 2017). Accordingly, innovation labs tend to hold unusual disruptive potential as dedicated safe spaces for innovations to occur (Tönurist et al. 2017; Carstensen and Bason 2012).

### **Case: Hospital testlab**

The studied PSI laboratory was established in 2015 by a Finnish public hospital district within a regional university hospital responsible for providing specialized health care for geographical area covering approximately half of the country. The lab is specialized as a test environment for novel health care product and service solutions by providing an

authentic hospital environment for health care and medical technology businesses to test and develop their solutions using feedback from the hospital's health care professionals. The lab was established in connection to the hospital's renewal project, in which the hospital is rebuilt entirely, and provides a facility for designing and testing new products, services, facilities, technologies and operational models to be taken to use in the future hospital. In addition to these two core objectives, the lab has been mandated to coordinate and develop hospital's internal innovation processes and culture to foster the generation and development of innovations originating from the hospital internally.

Finnish health care system as the study's general context is administratively highly decentralized yet fragmented regarding the financing and provision of services, leading to a widely accepted consensus of a need for significant reform of the system (Keskimäki et al. 2019). Accordingly, an on-going social and health care reform seeking ways to centralize health care provision is one of the biggest current changes in societal governance and practice in Finland. Also, with objectives to advance people's health and wellbeing and Finland's international position as a forerunner in health research and innovation, the Ministry of Economic Affairs and Employment has published a specific roadmap for research and innovation activities in health sector with its third iteration released in December 2020 (Finnish Government 2020). Measures put forth in the roadmap emphasise developing the funding and regulation of health sector innovation, investing in continuous learning and skills, and creating new partnership models between the public and private sectors in the domain. From the perspective of public health, the Finnish population is rapidly aging and increasingly suffering from chronic illnesses. These political, economic, and medical pressures are pushing health care providers to search for new ways to generate innovations that would ensure the quality of health care

services also in the future. The PSI laboratory examined in the present study is one prominent example of such objectives.

The first ideas on the studied innovation lab trace back to several rounds of strategy discussion in 2012 that preceded the founding of a local innovation ecosystem. A driving vision behind the ecosystem, established by the hospital district, region's capital city, an independent development unit of the local university and the local university of applied sciences, is to advance collaboration between public health care organizations and private actors in innovation processes. In 2015, the case lab became an integral part of this new ecosystem. Advancement of the lab was driven both by inquiries from the local health tech start-ups for feedback from health care professionals for their R&D processes and by the hospital personnel's expressions of difficulty in advancing their own innovative ideas. Eventually, the start of the hospital's renewal project was a substantial accelerator for realizing the lab for these purposes.

In practice, the lab premises offer 300 m<sup>2</sup> space to be converted as realistic hospital units, such as operating theatres, clinics, wards, control rooms and waiting areas according to the needs of company partners or the future hospital's design activities. The laboratory also offers a 3D virtual space and a state-of-art 5G mobile test network for various testing purposes. Within the local ecosystem, the lab forms a consortium with two other innovation laboratories one operated by the university of applied sciences offering testing services together with nursing students and the other by the city's primary health care services offering testing in social and health care centres as well as patients' homes.

The small size of PSI labs is often seen as a success factor, as an agile, start-up like structures enable quick communication and flexible processes for the innovation activities (Tönurist et al. 2017). Also the case lab has employed from one to two full time employees in charge of the lab's daily operations at large. The build-up of lab's funding

is rather typical for PSI labs based primarily on external project funding from local and EU levels as well as non-profit service pricing for the companies testing their solutions in exchange for the feedback, proof of concept and/or reference value. Major share of the innovative ideas jump-started by the lab have up to present originated from the local technology cluster with high density of small start-ups in health care sector. Aiming to avoid the high mortality rates of PSI labs (Tönurist et al. 2017), the ecosystem aims at present to expand the particular testbed model into broader regional development.

## **Methodology**

The empirical findings of the study are based on 29 in-depth, semi-structured interviews conducted within the hospital district managing the laboratory, the company partners and other stakeholders taking part in the local innovation ecosystem. List of the interview data with information on the interviewees' titles and affiliations as well as companies' size, type of innovation and the main interest in collaboration are found in Table 1. Interviews were gathered by teams of one to three interviewers of a university research group focused more widely on transformative change in public health care systems. The interviews focused specifically on the case laboratory and took between 35 and 153 minutes in duration, were audio recorded and transcribed verbatim for analysis. To gain empirical insight on the public innovation barriers, interview questions focused first on the reasoning and process of establishing the innovation laboratory by the public actors as well as the reasons for seeking collaboration by the company partners. Second, to address how the lab tackles the former innovation barriers, insight on the past outcomes, present activities and future objectives of the PSI lab was pursued.

*[Table 1 near here]*



From the few dozen private partners lab has been operating with during its lifecycle, twelve were purposefully selected (Eisenhardt 1989) based on the background information shared by the lab's manager. For variety, the sample consists companies of different sizes, including start-ups (SU1 to SU4), small and medium sized enterprises (SME1 to SME3) and multinational enterprises (MNE1 to MNE5), that produce different types of offerings such as hospital and self-care related goods, ICT systems and services. The gathering and analysis of company interviews continued until the point where theoretical saturation was reached and fresh interviews no longer produced greatly new insights (Silverman 2011). Where in most of the company examples, the development process related to gaining feedback, data and proof-of-concept from the interaction with health care professionals in the lab premises, also actual hospital environment was utilised with some of the companies. While many companies' solutions have moved forward to later procurement processes with public health care or have developed into commercial products elsewhere, some still remain in their prototype phases or have been discontinued by the studied partners.

The study's empirical analysis followed an abductive research approach and was carried out through continuous dialectic interaction between the existing research knowledge on innovation barriers and empirical case insight (Dubois and Gadde 2002). Thematic coding, categorisation and seeking of patterns from the data was conducted by two researchers via help of NVivo in three phases following the study's core themes. First, information regarding the innovation barriers in the public hospital setting was explored and coded (e.g. issues related to complexity). Second, the case lab's activities and decisions enhancing the hospital's innovation capability were identified and labelled descriptively (e.g. mobilizing and empowering of end-user groups). Finally, the impact

of these features on each of the recognised barriers was reflected to form a case-based illustration on the remedies offered by the PSI laboratory.

## **Case findings**

### ***Innovation barriers of a public hospital***

The most often recurring tensions addressed by both hospital and company informants in our case data relate to the general rigidity of public health care as a context. In innovation processes, the rigidity manifests, for instance, as rigorous safety certifications required from hospital and self-care products, high threshold from product development to procurement, powerful professional identities affecting innovation's spreading and slowness in public decision-making. Considering the hospital's organisational culture from the perspective of our initial innovation barriers, case informants recognise challenges of rigidity related to all four.

The barriers related to *complexity* showcase as issues in communication caused by divergent perspectives and institutional cultures both within the hospital organization as well as between the hospital and its multifaceted environment. Although issues concerning innovations often relate to conflicts caused by health care's strong professional identities, also the public obligation to serve exceptionally wide variety of different groups of staff, patients, researchers and municipal actors simultaneously is characteristic for the hospital. These barriers are evident in the interview quote below.

*You would not believe, what kind of tensions there exists between the medical profession and nursing staff. [...] There are also many other dimensions including this area. This is the university hospital of the region, which has its own objectives and duties. And then we have the basic health care of each municipality who again have their own decision-makers and interests. (Medical director, hospital district)*

As an example of complexity related issues in partnerships between public and private actors, hospital interviewees address organisational objectives at forming long lasting relationships to co-develop suitable health care products with the partner companies but perceive that the private developers in turn are primarily focused on quick sales. For the companies on the other hand, barriers for advancing innovation objectives are seen in lack of personal relationships and contact points to public health care. This results in what from the hospital's perspective appears as undesirable "wild" contact attempts (see quote).

*(Companies contact) whoever they happen to find and get a hold of by phone. These attempts have been wild. Sure, it's possible that operating this way we might find a single suitable technological solution, but when it comes to implementing new technology for the entire hospital, it does not work that way. And it's not based on any real need but rather on a sales push. (Lab manager, hospital district)*

In terms of barriers related to *risk-aversion*, the company informants associate the risk-averseness in the hospital especially with rigidity of hospital's practices and reliance on least risky, i.e., existing, solutions due to environmental pressures such as negative media and citizen attention. Interesting discovery was medical professionals' tendency to favour activities related to "development of treatment" while interpreting the term innovation as something additional or even threatening regarding the core health care tasks. In other words, also hospital culture's focus on caretaking above technical, commercial, or other emphases is a factor increasing risk-aversion in the domain, as explicitly addressed in the quote below.

*They (the medical staff) want to take care of people really well. That's what they want, not to innovate. [...] I'm still doing the same thing as before but I try to bend it (in a language) they understand. (Entrepreneur, health consultancy)*

From the hospital's perspective, the risk-aversion barrier often intersects with issues related to bureaucracy. For the hospital, being careful towards implementing new solutions is justified not only by needs to ensure the solution's suitability for the specific service but also needs to follow legislation protecting patients' rights. For instance, if patient data was handled inappropriately in the context of implementing an innovative software, specific hospital personnel are at risk of being personally accountable and facing legal consequences. Accordingly, what from the companies' perspective appears as cautiousness due to environmental pressures, from the hospital's perspective is indispensable for ensuring sufficient health services, protecting patients' rights or avoiding severe personal consequences.

Public hospitals typically suffer from lack of *competences and resources* that directly support the implementation of innovations. In the case hospital, this barrier appears especially as a shortage of organizational structures supporting innovation processes. Although several development activities do exist, they suffer from being scattered around the organization with little or no coordination between them and from the lack of expertise regarding the development of these activities. The following quote illustrates both the lack of innovation competence in the hospital and the complexity of common perceptions of public and private actors' motivation to collaborate.

*People had come to tell me that when they come up with something in their own work, they didn't know how to get the idea forward. Or that when they had carelessly talked about the idea for example to an instrument firm's representative, they noticed that half a year later the firm put out a product based on their idea. (Chief specialist physician, hospital district)*

An especially harmful competence related barrier is recognised by both public and private sector informants in taking the innovation from trials to procurement, which leads to piloting solutions but unfrequently proceeding from that stage onwards. Regarding

barriers related to resources, the case hospital's assets for innovation in terms of people, spaces and money are heavily scattered. Accordingly, the interviewees perceive that most prominently the innovation processes should be managed by entities external to the day-to-day health care activities and that this demands investments (see quote).

*You can develop in two ways, where you grow your own things besides your own work without any follow-up. This is mostly something that enhances what already exists. If you want to create something new, it normally calls for both financial and mental investments. (Development manager, hospital district)*

The barriers related to public sector *bureaucracy* are recognized by all interviewees but specified in detail especially by informants in managing positions of the hospital district. In the case hospital, regulatory elements affecting innovation processes include at least the own administrative rule and purchasing guidelines of the hospital district, Finnish Health Care Act (1326/2010), Finnish Act on public contracts and concessions (1397/2016) and the procurement directives by European Union (2014/24/EU) and European Commission (2004/18/EC). Besides hospital related bureaucracy barriers, companies hold their own regulatory challenges related to, for instance, patient safety requirements and international certifications (e.g. ISO standards) crucial to advance an idea into an established product. One company informant reflected on the bureaucracy barriers of public health care as follows:

*Hospital world as a business is very different as it is very slow to launch and to get sales negotiations started, you must do the trials and it can easily take a year or two to make real sales, proper transactions. It is again on consumer side when the product launches, its first month can be the best sales period. (CEO, SU1)*

Case hospital is also affected by political decision-making cycles that often prove challenging for agile development of innovations. Besides municipal councils and the joint municipal board, a political element to acknowledge are specific catchment areas

appointed to each university hospital in Finland. Informants also addressed internal bureaucracy hindering the organization's development activities. Due to the complex organizational structure and several decision-making bodies involved, hospital personnel's development ideas are in danger of getting stuck within the organizational processes (see quote).

*(In the traditional initiative process) they had to fill out over seven different forms for one initiative. So, there was quite a lot of bureaucracy involved, and sometimes the person who made the initiative got an answer and sometimes they didn't, and sometimes they did but only after two years. Everyone considered this as a heavy process and quite poor in activating and inspiring people to participate. (Innovation coordinator, hospital district)*

Prior to the analysis on the case lab's remedies, a few factors lowering the previous innovation barriers without active contributions from the PSI lab should be mentioned. First, a notable factor affecting PSI labs is Finnish national social welfare and health care reform in progress. By enhancing interest, support and available funding for health care innovations, the reform lowers the barriers for collaborative innovation policies at large. A second meaningful factor lies in the ICT technology focused region in northern Finland, in which the lab operates. However, whereas the network and cluster of tech companies around the hospital supports innovation and lowers the barriers for PSI, long distance from large-volume markets strengthens the barriers for collaboration outside the region. A third factor lowering the barriers for innovation lies in the hospital district's on-going investment on a new hospital building, resulting an unavoidable need to develop and adopt new innovations. Finally, a recurring factor raised by the partnering health sector companies is the specific nature of solutions related human health. Innovations with potential to save lives have proceeded through a fastened development and procurement especially during the COVID-19 epidemic.

### ***Remedies by the Hospital testlab***

The case data addresses multiple means regarding how the case PSI lab departs from the traditional practices by the public hospital. With most impact on innovation, the policy enables previously unavailable dialogue between private sector and health care professionals. These new forms of interaction ensure flexible adjustment of the solutions as well as enable completely new functionalities to be born (e.g. SU1 developed a new remote application supplementing the physical gadget). In terms of tangible outcomes, the PSI lab enhances the functionality and quality of products, services and systems developed and saves resources on companies' independent development activities. Validation needed in different phases of the innovation process is especially important for the partnering companies. Depending on the circumstances, the validation might focus on observing commercialisation possibilities for the idea, recognising and fixing specific flaws in the solution, or the solution's final testing prior to market introduction. In terms of intangible outcomes, the case lab enhances the relationships and networks between public and private actors especially on a local level and advances innovation-supporting discourse within the hospital units.

In the data analysis, we identified 31 specific activities and decisions that positively influence the public hospital's innovation processes listed in Table 2. With a total of 124 checkpoints, each feature was then reflected to the previously discovered public hospital's innovation barriers and considered whether it a) "impacts the barrier", b) "does not impact the barrier" or c) "findings on the impact are indecisive". For further treatment, the features were subsequently categorised under groups based on the barrier they affect most. Altogether five of the features were seen to tackle all four barriers (*marked in italics*).

*[Table 2 near here]*

The public hospital's innovation barriers related to complexity are tackled especially by PSI lab's features which add interaction on both inter- and intraorganisational levels. Although patient centeredness has been continuously emphasised throughout the hospital's working culture, more coordinated mobilisation of the medical staff and co-production in the patient interface has been widely enhanced by the PSI lab (see quote). From the perspective of partner companies, new forms of dialogue open routes to public relationships and testing opportunities with health care professionals formerly unattainable. Establishing and joining new networks on local, national and international levels has had a crucial role in grasping how the particular hospital environment might be utilised for innovation. For the case lab, the local innovation ecosystem is especially crucial for tackling complexity but also shortages in competences and political support concerning innovation.

*When we have had the lab functions, we have been able to advance all co-production based on that. And when we have this one physical location like the lab, it is like a honeypot to gather those co-production initiatives. (Director, University)*

Tackling the issues of risk-aversion illustrate widely as case lab's features enhancing the orientation towards commercialisation within the hospital's innovation processes. Whereas few earlier commercial intentions were revealed in the interviews concerning a single innovation partnership or prototype testing in a single care unit at the time, agile prototyping and different service levels offered to health care companies by the PSI lab are novel for the hospital. Lowering the hospital organisation's risk-aversion, the policy propels external funding calls utilised for development, delegates risk to be carried by the lab as hospital's separate in-house unit as well as translates the innovation objectives to



health care professionals in more understandable manner. Especially the studied start-up companies experienced the lab's affordable (non-profit) pricing and flexibility lowering their threshold to take development risks and considered the public hospital's reference value highly beneficial for the solution's further commercialisation (see quote). Whereas licensing and ownership of innovative solutions are at present not common for Finnish public hospitals, also joint ownership of innovations by the private and public partners is repeatedly mentioned in hospital district's future objectives for the PSI policies.

*The meaning of references is immense. Everything happens through that (public hospital) reference, which is something that we cannot emphasise enough.[...] If we've been through this Finnish system and got thumbs up, we can presume the reference is strong globally too. (CEO, SU4)*

In terms of the hospital's innovation barriers related to lack of competences and resources, the PSI lab proves rather effective in enhancing both inter- and intraorganisational learning in its functions. From early on, the lab's establishment has been reasoned both as a direct simulation platform for the new health care innovations as well as indirect policy to develop the hospital's general innovation culture. For maximizing the competences and resources available for innovation processes, sharing the operative work between ecosystem actors and two other test laboratories has been beneficial for the case lab. This has prevented the specific capabilities from isolating and instead effectively united the needed health care, business, management and research understanding around the same table. Interestingly, learning between the hospital units and partner companies in the hospital was seen both to amend the existing gaps in innovation expertise but also bringing competitive edge in attracting (and keeping) innovation-oriented medical professionals in public health care environment with high staff turnover rates (see quote). As spreading many of the lab's learnings within the hospital organisation is still largely

under progress, the hospital's success in scaling the competences further is not yet fully analysable.

*Although we are a public actor, I would not be jealous if we were able to rent some piece of land and build places here not only for education and research but also for innovation and this kind of health technology development. I see it as a win-win-situation which could be a pulling force for us to compete on the decreasing number of top professionals in health care. (Chief director, hospital district)*

The interview data at large illustrates least effect by the case lab on bureaucracy related barriers met by the hospital. The impact that the PSI lab does have on regulatory and decision-making issues mostly relates to its unusually high level of independence from the hospital's core activities. Accordingly, case lab's autonomous positioning allows it to avoid for instance limitations related to safety and privacy of real patients and patient data (see quote). Although a questioning perspective on hospital's existing norms and organisational culture adds the lab's disruptive potential to recognise problems with existing policies and rules, it cannot dissolve the political nature of public health care in general. On contrary, data reveals a danger that the lab creates a political blindspot for the company partners or the hospital staff; e.g. by causing false presumptions that the hospital could implement the innovations without considering procurement regulation. Eventually, taking the co-developed innovation from testing to potential procurement and implementation stages tends to take the same effort and undergo through the same procedures as any other solution tested outside the hospital.

*We don't have the same rules what can be tested as we don't have to acknowledge patient safety yet. Of course we aim for it with more established products, but you can also test half-finished products and it does not cause danger to patients. And still we can try them with genuine professionals. That is our clear strength. (Lab manager, hospital district)*

## Discussion

A case-based illustration of the key innovation barriers in the public health care context and the innovation laboratory's remedies to tackle them is presented in Figure 1. In addition to addressing the key mindset behind each remedy (*R1 to R4*), the figure indicates each remedy's strongest connection to one of the investigated innovation barriers (*B1 to B4*) and the degree of impact on each innovation barrier by the PSI lab as a whole. Our findings indicate the impossibility of viewing barriers as isolated obstacles terminated by any single remedy offered by the PSI policy. Instead, the findings corroborate with Termeer (2009) by revealing that barriers to accomplish new modes of governance tend to reinforce each other, which makes them even harder to overcome.

*[Figure 1 near here]*

Fundamentally, the impact of the PSI lab as a collaborative innovation policy grows strongest in enabling opportunities for *reciprocal dialogue and networks* that prevent and solve conflicts caused by participants' different social identities and institutional cultures affecting the innovation process. Similarly, the policy enhances *inter- and intraorganisational learning* that tackles the participants' lack of expertise and resources concerning the specific innovation process as well as long-term shortages in hospital's innovation competences. The PSI lab also adds *commercially focused reasoning and actions* within the PSO and can help in translating innovation process more clearly for interested health care professionals. Yet, many of public health care's rigid organisational practices and doubtful interpretations of innovation attached to strong professional identities tend to still guide individuals in the domain towards risk-averse behaviour hesitant to innovation. Finally, although the PSI lab's *autonomous position and*

*ability to challenge the hospital's existing innovation measures* can lead for instance in better utilisation of the present regulation, the policy's impact on the PSO's innovation barriers related to bureaucracy are minor.

Successful adoption of collaborative innovation policies such as PSI labs calls for absorptive capacity and externally focused corporate culture from the hospital (Cacciabava, Guimaraes, and Harrington 2006). As the present findings support this addressment, the interview data also indicates that the PSI lab has an impact on the hospital's broader culture towards innovation, for example by initiating training hospital personnel in the wards into a novel innovation ambassador role. Accordingly, the findings suggest that the PSI labs spreads specific *culture of connectedness* within the hospital via the interaction, commercialisation and mutual learning focused mindsets. Where innovation in public health care attaches strongly to professionals' values and norms associated with innovation (Williams 2011), the PSO's capacity to collide the isolated professional cultures is improved by the lab.

In addition to ineffective tackling of bureaucracy issues, there are few other public innovation challenges recurring in the case data with little effect by the PSI lab. First one relates to answering to health care's growing interest on user-driven innovation (cf. von Hippel 1988). Although the PSI lab does form new linkages between the innovation's end-users and private developers, collects ideas from hospital personnel and exploits the data and knowledge of the hospital, it is still mostly the partnering companies that produce the ideas triggering co-development of innovations. Accordingly, the interaction and networks enabled by the policy are not fully capitalised to answer the needs of the health care professionals' or patients' for reshaping products, services and systems. A second challenge relates to private sector's pursuit for continuity from the innovation partnerships with PSOs. Disappointing many collaborating companies and health care

professionals, PSI lab does not form direct pathways to the following sales stage and broader adoption of solutions in public health care. Accordingly, the public-private partnerships in health care innovation labs are to be understood as a collaborative policy tool in action rather than a procurement tool directly for commercial purpose (cf. Torchia et al. 2015).

## **Conclusions**

Regarding the importance of understanding both private and public sector ecologies for innovation (Mazzucato 2011), this study contributes to the debates on innovation processes in public health care and PSI labs as a form of collaborative innovation policy (Torfing 2019). Although health care systems carry some specific hindrances in terms of innovation (e.g. Fascia and Brodie 2017; Barnett et al. 2011), the studied public health care context with a complex range of administrative spheres (local, regional and national policies) and different types of innovations (products, service and systems) is considered moderately generalisable regarding the innovation barriers in other public service domains such as education or social services (Cinar et al. 2019).

Results of the study suggest that innovation labs have three kinds of fundamental effects on the innovative capacity of public organisations. First, labs are effective in motivating health care's frontline organizations to devote their expertise and resources to innovation. Recognising for instance the health care professionals' cautious interpretation of innovation as a term, the lab's ability to translate the innovative objectives into more accessible format alone can be decisively important for the innovation process. Second, labs can shape the public organisation's culture towards increasing responsiveness for interorganisational collaboration with various actors. As such, our findings corroborate with Tõnurist et al. (2017) seeing PSI lab primarily as a tool to make sense of the growing

complexity of public sector's problems. The latter effects are also increasingly essential for the continuity of public health care systems of the future (Cucciniello and Nasi 2014).

Third, PSI labs raise the public organisation's involvement in its surrounding networks. In this case study, the lab had an important role in not only forming and steering a local network in pursuit of health care innovation, but also maintaining the network's continuity for future collaborations. Indicative of the lab's ability to maintain connections between actors is the fact that innovation collaborations between private sector partners and the hospital continued throughout the COVID-19 pandemic that restricted the use of the lab's physical facilities. Whereas the concrete meeting place provided by the lab's physical premises was crucial when initiating the relationships between the individuals, recent developments reveal that once the connections are built, they could be maintained also without the material surroundings. Furthermore, although the labs' ability to unite and form bilateral partnerships across sectors has a primary importance in triggering innovations, an innovation lab functioning purely as a mediator between medical professionals and innovating firms meanwhile disregarding the wider range of relevant stakeholders in the collaborative arena (e.g. Hartley et al. 2013) is not viable.

On the other end, the study's results indicate innovation labs rather insufficient in improving the public organisation's capacity to overcome the formal structures hindering innovation. Outside few exceptions related to, for instance, the use of artificial data and policy's independence from some of the rigid practices of the hospital, the lab could not grant significant freedom from the rules and norms affecting the development of health care innovations. Accordingly, the bureaucratic structures play an undeniably vital role in shaping which innovation policies are applied and how they are implemented (Suzuki and Hur 2020). As especially the legislation and procedures related to patient rights and multilevel decision-making were found challenging by most interviewees, we recognise

a tempting avenue for future research in examining what kind of public innovation policies, if any, can truly tackle these issues.

Furthermore, the case lab enhances the PSO's innovative capacity mostly in the development and implementation stages of new ideas (Eggers and Singh 2009), which contrasts the ideal of innovation labs involving citizens and other end-users in collective in earliest problem framing stage (McGann et al. 2018). Accordingly, the present case lab did not specifically guide the private markets to solve the grand challenges of public health care (Mazzucato, Kattel, and Ryan-Collins 2019).

### **Policy implications & limitations**

Possibility to apply collaborative ways of policymaking depends on the authorization processes by public managers and decision-makers (McGann et al. 2021) discovered rigid including the present study context. As such, although the study focuses on a mostly autonomous entity within the hospital, many of its most impactful functions concerning enhanced interaction and education of professionals can be adopted by public organisations without the establishment of separate innovation units. Instead, the study suggests joining and establishing networks which support the PSO's innovative objectives. As addressed by Williams (2011), seeking fitting networks and ecosystems can be especially valuable for smaller public health care organisations lacking the expertise and resources to adopt major new ways of working. Another managerial implication derived especially from interviews with company partners, is that public organisations are still too often neglected as innovation partners due to heavier formalisation and some deep-rooted prejudice. As addressed by Osborne and Brown (2013, 566): "public sector, with its range of organisations, actors, stakeholders and users,

is more innovative than its reputation for being slow unwieldy, bureaucratic and lacking in R&D capacity would have us believe”.

The present study is naturally not without limitations. Also within public health care, the circumstances, institutional design and the type of innovation determine the variation in how strongly different innovation barriers emerge and how the PSI lab enables to overcome them. In addition, the concept of innovation lab is based on very heterogeneous solutions in terms of activities, scale and structure (Tönurist et al. 2017), which makes drawing universal conclusions challenging. Methodologically, where an exploratory case study benefits from a rich case visualizing the issues of an emerging topic, its validity and reliability can be criticised for scarcity in existing theoretical hypotheses and its highly adaptive research approach (Streb 2010).

Besides economic factors such as efficiency, productivity and effectiveness central to private innovations, broader ideological and social concepts should be embedded in the assessment of public innovations (Cucciniello and Nasi 2014). Similar challenges in forming exact measures for the PSI lab’s social and cultural impact were identified in the present study. Accordingly, in addition to the evident space for additional and comparative studies on PSI labs, further studies exploring the measures of collaborative innovation’s social and ideological impacts are suggested.

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## Tables

Table 1. List of the case interviews.

#	Informant	Duration	Date
<b>Hospital district</b>			
<i>1</i>	Lab manager	86 min	26.3.2018
<i>2</i>	Expert physician	153 min	31.10.2018
<i>3</i>	Medical director	112 min	6.11.2018
<i>4</i>	Development manager	62 min	14.11.2018
<i>5</i>	Innovation coordinator	39 min	29.1.2019
<i>6</i>	ICT director	63 min	11.2.2019
<i>7</i>	Chief specialist physician	48 min	26.2.2020
<i>8</i>	Chief director	58 min	5.6.2020
<b>Company partners</b>			
<i>9</i>	CEO (SU1, prototype testing, infusion therapy solution)	61 min	22.5.2020
<i>10</i>	Head of verification & validation (SU2, clinical testing, sleep apnoea detection)	35 min	22.5.2020
<i>11</i>	CEO (SU3, clinical testing, brain wave monitoring)	58 min	25.5.2020
<i>12</i>	CEO (SU4, prototype testing, gadget for premature infants)	42 min	3.12.2020
<i>13</i>	Development & communications mgr (SME1, product co-development, hand disinfectant monitoring)	57 min	2.12.2020
<i>14</i>	Account manager (SME2, product display, nurse call system)	49 min	4.12.2020
<i>15</i>	CEO (SME3, product testing, toilet seat assistant)	61 min	7.12.2020
<i>16</i>	Sales & customer engagement lead (MNE1, product testing, pharmaceutical care)	58 min	30.11.2020
<i>17</i>	Business development mgr (MNE2, prototype testing, indoor positioning system)	47 min	2.12.2020
<i>18</i>	Sales & product specialist (MNE3, product display, neonatal incubator device)	48 min	2.12.2020
<i>19</i>	Solution manager (MNE4, product testing, electronic door displays)	38 min	3.12.2020
<i>20</i>	Business development executive (MNE5, synergy project, innovation ecosystem)	53 min	3.12.2020
<b>Other stakeholders</b>			
<i>21</i>	Director of change (region council)	125 min	19.2.2018
<i>22</i>	Technology specialist (region capital, primary health care)	46 min	23.4.2019
<i>23</i>	Ecosystem manager (1 <sup>st</sup> , region capital, business development)	53 min	26.4.2019
<i>24</i>	Ecosystem manager (2 <sup>nd</sup> , region capital, business development)	51 min	24.2.2020
<i>25</i>	Development manager (university)	69 min	23.3.2020
<i>26</i>	Director (university)	91 min	10.6.2020
<i>27</i>	Director of development & resources (municipal council)	123 min	2.1.2018
<i>28</i>	Entrepreneur (health consultancy)	59 min	9.3.2020
<i>29</i>	Senior lecturer/lab manager (university of applied sciences)	50 min	7.2.2020
		<b>= 31 h 12 min</b>	

Table 2. PSI lab features with impact on hospital's innovation barriers.

PSI barrier	Complexity	Risk-aversion	Competences & resources	Bureaucracy
<b>Feature added /enhanced by the PSI lab</b>	<p>Creating novel connections across companies, hospital staff &amp; other stakeholders</p> <p>Interdisciplinary co-creation/co-design</p> <p>Mobilizing &amp; empowering of end-user groups</p> <p>Establishing/joining local, national &amp; international networks</p> <p>Sharing the operative work within the ecosystem</p> <p><i>Pursuing trust &amp; companionship with company partners</i></p> <p><i>Acknowledging company partners' development needs</i></p> <p>Dialogue enabling space arrangements</p> <p>Transparent communication towards citizens</p> <p>Lowering the companies' thresholds to make contact</p>	<p>Productised services offered to company partners</p> <p>Healthcare professionals' input incorporated into product development</p> <p><i>Agile &amp; flexible (private sector like) operation models</i></p> <p>Utilisation of external funding (national /international)</p> <p>Joint ownership of innovations &amp; establishing public enterprises</p> <p>Innovation risks carried by hospital's in-house organisations</p> <p>Certifications &amp; references for company partners</p> <p>Acceleration of organisational innovation objectives (public/private)</p>	<p>Learning across hospital units</p> <p>Learning between public organisation &amp; company partners</p> <p>Support for atypical ideas &amp; internal motivation for development</p> <p>Innovation as a pulling force for recruitment</p> <p>Scaling new competences to new units</p> <p><i>Collecting market &amp; buyer understanding</i></p> <p>Future continuation of the partnerships</p>	<p>Better utilization or evasion of regulation</p> <p>Autonomous positioning within the hospital</p> <p><i>Joint planning of the innovation processes (incl. educating people about the limitations)</i></p> <p>Denotation of deadlocks &amp; blind spots in the existing policies</p> <p>Negotiating resources for authentic test environments (e.g. wards &amp; operating rooms)</p> <p>Utilising patient information systems with artificial data</p>
	<b>→ Added interaction</b>	<b>→ Added commercialization</b>	<b>→ Added mutual learning</b>	<b>→ Added independence</b>

## Figures

Figure 1. PSI lab tackling the barriers of public sector innovation.

